THE CIVILIAN

DEPARTMENT MAGAZINE

Issue 23
FALL 2018

ANNOUNCING A NEW NAME FOR OUR DEPARTMENT

WHAT'S IN A NAME

Civil & Mineral Engineering
UNIVERSITY OF TORONTO

ISSUE 23
FALL 2018

Advisors

Professor Brent Sleep
Nelly Pietropaolo

Editor in Chief

Keenan Dixon

Assistant Editor

Kevin Floether

Writers & Contributors

Keenan Dixon
Kevin Floether
Rachel Wallace

Design

Keenan Dixon

Department of Civil & Mineral Engineering
University of Toronto
35 St. George St.
Toronto, ON
M5S 1A4

civmin.utoronto.ca

instagram.com/civmin

youtube.com/civmin

facebook.com/civminutoronto

twitter.com/civmin

Send your letters to **civ.communications@utoronto.ca**

Letters may be edited for clarity and length.

I'd like to take this opportunity to update you on a number of exciting events from the past year. In March 2018, following wide consultation, the Department's name was formally changed to Civil and Mineral Engineering. This new name better reflects our community and our support of both the Civil Engineering and the Lassonde Mineral Engineering Programs.

To that end, this will be the last 'Message from the Chair' for the Civilian Magazine. The Civilian will be renamed to better reflect both the civil and mineral engineering aspects of our department. Over the coming year, we will invite comments, suggestions and participation as we embark on this process to find a new meaningful magazine name. If you have any initial thoughts, please feel free to reach out and share your ideas.

I'm honoured to accept another five-year term as Department Chair. I look forward to the opportunity to continue to work with students, staff, professors and alumni. Along with my colleagues, we will work to maximize the impact of our research, improve the educational experience for our students, and provide opportunities for alumni engagement with the Department.

This spring, the University launched the School of Cities with the goal of convening urban-focused researchers, educators, students, practitioners, and the general public to explore and address complex urban challenges, with the aim of making cities and urban regions more sustainable, prosperous, inclusive, and just. With two of our faculty members on the steering committee and most of our researchers working on city related issues, it is fitting to explore some of the relevant research that is ongoing in the department.

There is still a lot of activity happening outside the city as well. As I write this note, the annual Civil and Mineral Practicals (CAMP) course, held at our Gull Lake Camp is under way. This year, with support from the Dean's Strategic Fund, we have expanded the environmentally focused exercises with two new boats and a host of new equipment for environmental analyses. As we approach the hundredth year of engineering students attending the Gull Lake Camp, we have exciting plans for renovations, as outlined in this issue of the Civilian.

Also in this issue, we consider how new methods are being developed to take advantage of the advances in unmanned aerial vehicle technology. From parcel delivery to construction management and nuclear plant inspections to aerial mine evaluations, we see how this technology has incredible potential for our profession.

We love hearing from our alumni and would love to continue to stay CONNECT-ed with you as your career and impact in this world evolve.Please join the discussion on our Faculty professional platform, UofTEngineeringConnect.ca.

Brent Sleep

Professor Brent Sleep

CIVIL & MINERAL

250
New Students

407k
in donations

30+
Industry Partners

16+
LABS

16
RESEARCH CHAIRS

11.84+M
Total Research Funding

BREAKING NEW GROUND AND TAKING TO THE SKIES

How drones are being leveraged for Civil and Mineral Engineering

22

FEATURES

IN THIS ISSUE

WHAT'S IN A NAME?

Why it matters that we are now the Department of Civil & Mineral Engineering

In March 2018, the University of Toronto's Executive Committee of Governing Council approved a new name for the Department of Civil & Mineral Engineering, an update that reflects the Department's strong community and the breadth of knowledge and expertise of its members.

"This important change captures and communicates the true make-up of our vibrant community," said Professor Brent Sleep, Chair, Department of Civil & Mineral Engineering. "Our new name reflects all of our offerings and the strategic vision for our Department. We are leaders in education and research in systems-based approaches to developing sustainable solutions for the global community across the spectrum from mineral engineering to urban infrastructure."

The new name was arrived at through an extensive collaborative consultation process, with input and valued opinions from Department stakeholders. While the name change does not alter departmental structure or programs, it creates exciting opportunities to strengthen connections among the Department's entire undergraduate community, solidifies ties with all alumni and deepens existing connections to industry and employers.

"The Department's new name reflects how engineering is practiced in the 21st century," said Dr. Paul Cadario (CivE 7T3) Adjunct Professor and Distinguished Fellow at the Munk School of Global Affairs and Public Policy. "Since the two disciplines have major real-world synergies, bringing Canada's two premier programs closer together will help students better steward the economic, social and environmental impact of the projects they will work on as engineers."

The change recognizes the natural integration and continuum from mineral engineering to civil engineering. Mineral engineers provide the raw materials for civil infrastructure and both have strengths in geotechnical engineering, geomechanics, and earth systems — whether the application is subway tunnels, embankments, or surface and underground mines. Sustainability, protection of the environment, and social responsibility are central tenets of both disciplines.

The Lassonde Mineral Engineering Program came under the umbrella of the Department of Civil Engineering in 2005 to better allocate administrative support and resources. Since then, the links between the civil and mineral engineering disciplines have grown stronger. This name change further solidifies that vital connection and enables growing collaborations across the Department.

"A name change recognizes how important all members of this community are to the Department and to the Faculty; all Lassonde Mineral Engineering and Civil Engineering students, alumni, professors and staff are a part of this great Department and we all stand together," said Valeria Baranova, a fourth-year student in the Lassonde Mineral Engineering Program.

A TIMELINE ON CIVIL, MINING, GEOLOGICAL AND MINERAL ENGINEERING AT U OF T

1861
First diploma in Civil Engineering granted to C.F. Robertson

1870
Academic Calendar states that studies for a diploma in Civil Engineering must include courses in Mineralogy and Geology

1878
Mining made its first appearance as "Assaying and Applied Geology"

1885
First BASc in Civil Engineering granted to J.L.Morris

1892
Mining Engineering established as a program of study

1920
U of T establishes a site on Gull Lake for Survey Camp, a course held annually in the summer to instruct and provide field experience to Mining and Civil Engineering students

1937
Mining Geology added as a program

1953
Mining Geology program changed to Applied Geology program

1965
Mining Engineering and Applied Geology programs merge to form Geological Engineering, with many courses overlapping with the Department of Geology

1973
Division of Geological Engineering and Applied Earth Science established

1975
Program changed to Geological Engineering and Applied Earth Science

1983
Program changed back to Geological Engineering

1989
Canadian Mining Hall of Fame established on the first floor of the Mining Building

1991
Program changed to Geological and Mineral Engineering

1996
Landmark gift of $4 million from Dr. Pierre Lassonde revolutionized the study of Mineral Engineering at U of T

1999
Program changed to Mineral Engineering

2001
Program changed to Lassonde Mineral Engineering

2005
Division of Mineral Engineering merged into the Department of Civil Engineering

2018
Department name changed to Department of Civil & Mineral Engineering

2017 2018 Awards & Honours

Faculty

INTERNATIONAL

Honorary Member of the American Concrete Institute Electee
Doug Hooton

CANADA

Canadian Academy of Engineering Fellowships
Robert Andrews & Heather MacLean

Canadian Society for Civil Engineering: Sandford Fleming Award
Baher Abdulhai

Canadian Society for Civil Engineering: Horst Leipholz Medal
Shamim Sheikh

Engineering Institute of Canada Fellowship
Brenda McCabe

Ontario Professional Engineers Award: Young Engineer Medal
Jennifer Drake

Canadian Foundation for Innovation: John R. Evans Leaders Fund
Marianne Touchie

Canadian Foundation for Innovation: John R. Evans Leaders Fund
Leslie Warren

Canada Research Chair: Renewed
Constantin Christopoulos

NSERC Discovery Accelerator
Brent Sleep

NSERC Industrial Research Chair: New
Giovanni Grasselli

NSERC Industrial Research Chair: Renewed
Robert Andrews

NSERC Industrial Research Chair: Renewed
Ron Hoffman

Ontario Centres of Excellence TargetGHG Collaborative R&D Grant
Heather MacLean

Ontario Early Researcher Award
Jennifer Drake

Ontario Ministry of Labour Research Grant
Brenda McCabe

Students

CITE WSP Undergraduate Scholarship
Syed Imam (CIV 1T7 + PEY)

2018 TA Teaching Excellence Award
Pedram Mortazavi (CIV PhD Candidate)

2018 Henry Granjon Prize
Kyle Tousignant (CIV PhD 1T7, CIV 1T2)

2018 Cressy Award Winners
Sara Maltese (CIV 1T7 + PEY)
Nataliya Pekar (CIV 1T7 + PEY)
Edvard Bruun (CIV MASc 1T8, CIV 1T4 + PEY)

4 WAYS TO GIVE BACK TO YOUR DEPARTMENT

RELATIONSHIPS

Help us grow our industry network.

VOLUNTEER

Give your time as a mentor or come back to campus to give a talk to current students.

DONATE

Support through gift-in-kind or financial donations.

JOB OPPORTUNITIES

Let us know when your company is looking for high-quality new graduates or PEY Co-op students

Contact:
civ.communications@utoronto.ca
to get involved today.

PERSPECTIVES ON CITIES

With condo towers being erected in cities around the world, cities are experiencing unprecedented growth and development. The densification of cities is putting more pressure and demand on transit systems, infrastructure, utilities and environment.

The impacts of each new development can have wide ranging effects. Researchers at the University of Toronto are working to better understand, and in turn inform, the impacts of each decision to ensure that our cities are built to last, are cost effective, and limit the strain on our natural resources and the environment.

Meet five professors who are better informing the debates about how our cities carry on with daily operations.

Professor Heather MacLean
INFRASTRUCTURE

Professor Heather MacLean develops and applies systems-level approaches to quantify and evaluate the environmental and economic impacts of different engineering projects and processes. She has examined the life cycle energy use and greenhouse gas emissions associated with urban and suburban developments, including the production of building materials for housing and energy required for transportation. Currently, her research is focused on determining the environmental and economic implications, from a life cycle perspective, of a large set of conventional and alternative fuel and vehicle options for personal and freight transportation.

Understanding the systems level and life cycle environmental and economic implications of different development scenarios is critical to inform a variety of stakeholders from policy makers to contractors and consumers, who all play a vital role in making our cities more sustainable.

It's important to focus research on cities because of increasing levels of urbanization. About half of the world's population lives in cities, which has a few effects. First, cities are playing an increasingly important role in the global economy because of the large populations who live in them. Second, there is an increased awareness of the fact that cities are large contributors to greenhouse gas emissions. Third, it is predicted over the next 30 years, almost all population growth in the world will be in cities in developing countries. Particularly in these emerging nations, where many more cities are expected to become megacities (cities with a population of over 10 million), there is an opportunity to inform more sustainable outcomes for these cities through appropriate planning and using an evidence-based approach. Hopefully, this can avoid many of the errors we have made in the planning and development of cities in mature economies.

Future levels of urbanization are expected to be even higher than they are now. Even at current levels many cities are struggling to provide adequate services and infrastructure for their residents and maintenance is severely lagging in many developed and developing regions.

There are a number of trends that coincide with this increase in urbanization. Some sustainable trends include an increased focus on developing walkable neighbourhoods, promotion of active modes of transport, car sharing, expansion of public transport options, and increased attention to energy efficiency in buildings. However, there are other trends that cities must also come to terms with including a desire for larger homes, consumerism and the 'throw-away' nature of many products. If there isn't due attention paid to these trends, cities will need to respond to the many negative economic and environmental impacts.

Professor Matt Roorda
TRANSPORTATION & LOGISTICS

Professor Matt Roorda and his team at the University of Toronto research freight transportation and logistics, and curbside management in urban areas. They investigate better methods to optimize freight systems to improve their efficiency, taking advantage of new technologies (e.g. automated vehicles, drones, electric bicycles), and innovative new processes. They also develop city-wide models of freight transportation to predict the impact of freight on congestion, emissions and safety. This is important in a time where delivery of items is becoming increasingly complicated due to space and traffic constraints.

These constraints present specific challenges that Roorda and his team are looking to solve. Congestion, in particular, is a topic receiving a lot of attention because people living in cities deal with it everyday. This is true for both public transit and roadways. Infrastructure designed to relieve the pressures of congestion is needed. However, infrastructure projects are expensive and prone to extensive public debate. Roorda and his team are working to add evidence and fact-based analysis to inform decisionmakers when considering transportation infrastructure.

Another challenge for cities is to make better use of urban spaces. Urban areas have the potential to be more sustainable than sprawling suburbs. Cities must approach space allocation n new ways for urbanization to be successful. The curbside management research done by Roorda's team focuses on ways to use street spaces more efficiently for transportation, delivery services, and make them great places to walk and cycle.

Roorda points to Peel Region as a municipality applying his research well. Peel is a freight hub in Canada. It has a very large distribution centres serving all of Toronto, southern Ontario and beyond. Roorda's team has worked closely with Peel Region on pilot projects, including one that focuses on making deliveries in off-peak times.

Roorda thinks that one of the biggest questions in the coming years will be the introduction of vehicle automation. This technology could be beneficial if these vehicles can increase capacity, improve safety, reduce emissions (if they are electrified), and improve mobility for elderly and disabled. Alternatively, this could increase congestion and increase the number and length of vehicle trips.

Professor Marianne Touchie
BUILDINGS & ENERGY

Assistant Professor Marianne Touchie is researching ways to improve the quality of indoor environments while also reducing building energy use. She specifically focuses on aging high-rise multi-family housing in cities. Using the Building Energy and Indoor Environment Lab, Touchie conducts primarily field-based research, examining the performance of existing buildings through monitoring and occupant surveys, and attempting to determine potential operational or retrofit strategies to improve performance.

Touchie hopes the lessons learned in the field, and the solutions modelled and tested in the lab and the field, can be integrated into policies and programs to influence the design of future cities. An example of this is a current study testing new control strategies for smart thermostats to reduce energy use in new condos, while achieving thermal comfort for occupants. The study involves several user groups, including local utility companies hoping to integrate findings into their energy-conservation programs.

In an effort to meet 2050 greenhouse gas emissions reduction targets, cities need to do more than just halt construction on new buildings. They would need to reduce energy use in existing structures. Around half of emissions in cities are a result of building operation, meaning significant energy retrofits are needed before 2050 to meet our goals. Furthermore, any new buildings must not contribute to the environmental burden and, if possible, should produce more energy than it uses.

In Europe, cities have benefitted from a stringent energy policy regime, but also a very important and differentiating factor – substantially higher energy prices. The argument, however, needs to be framed differently to be effective in Canada. It needs to be conveyed that low energy buildings are usually more comfortable, durable, and resilient to changing weather conditions. Beyond pushing for small energy cost savings, cities should also be demonstrating the broader benefits of higher performance buildings to both occupants and owners.

One of the most concerning trends Touchie identifies is increased use of air conditioning, since it uses a lot of energy to compensate for poor building and envelope design, particularly in contemporary glass buildings. Glass buildings are energy intensive, but also uncomfortable for occupants who experience a wide range of thermal and visual comfort issues. In recent years, restrictions have been placed on the proportion of glazing allowed in buildings, but this is only a start. The goal should be to find ways to allow our buildings to be operated more sustainably.

Professor Paul Gauvreau
STRUCTURES & BRIDGES

Professor Paul Gauvreau researches new designs for structures and bridges – an often overlooked aspect of city infrastructure. Bridges tend to be an afterthought, serving primarily a functional purpose, unless they're not. He defines two different types of bridges; premium bridges on which money is spent for aesthetic purposes, and practical bridges for which no aesthetic premium was paid. Focusing on the latter, Gauvreau believes these can be done better and be made more aesthetically pleasing than they currently are.

Particularly in cities, the focus tends to be on building premium bridges. The Champlain Bridge in Montreal (expected cost of $4 billion) is an example of how much a premium bridge can cost. Several design features of the bridge offer nothing in the way of functionality, so it can be assumed these features are purely aesthetic. Common estimates for aesthetic premiums paid for bridges fluctuate between one to 10 per cent. Conservatively, the aesthetic premium on the Champlain Bridge is estimated at $40 million.

Beautiful bridges can be built without paying a premium. "Bridges don't need to be extravagant to be aesthetically pleasing," says Gauvreau. "There is a perception that if a lot of money is spent, it leads to a beautiful bridge, while spending less leads to an uglier one. This is not the case. Practical bridges doing their job well have the potential to be beautiful."

It comes back to the debate over whether the aesthetics of bridges should be publicly financed. Practical bridges can be constructed to look better by innovating our designs and approaches, without paying a premium. There are plenty of opportunities to build with new materials or to build with new combinations of existing materials.

Bridges are a necessary part of the infrastructure of many cities and they impact city life in several ways, which can be improved. First, the value/cost paradigm needs to be re-evaluated. Bridges have the potential to be built for lower capital cost. By adopting newer ideas and materials, it's possible to do things more cheaply and more efficiently. Second, disruption during construction must be limited. This is especially true in densely populated cities, where infrastructure projects inconvenience many. Third, bridges can be used to create a better visible environment. Bridges are permanent and visible on a daily basis. Their permanence makes it essential that they are made to look as pleasing as possible. A poorly designed bridge can affect a region's mood or emotion for decades.

As an example of design which is both pleasing to the eye and highly practical, is the Bell-47D1 helicopter. Designed by Arthur Young, this was an aircraft crafted, primarily, with functionality in mind. yet there is a quality of beauty to it. Similar to the helicopter, bridges have the potential to be simple, functional, and yet quite beautiful. (Photo credit: Bell-47D1 Helicopter, by Neil R via Flickr, under CC BY-NC 2.0)

Professor Shoshanna Saxe
INFRASTRUCTURE DESIGN & PLANNING

As cities continue to grow in size and importance, so does the need for them to be sustainable. Sustainability can mean a lot of things, but Assistant Professor Shoshanna Saxe is interested in understanding and improving the planning, design and construction of urban infrastructure.

"There is an intimate relationship between the things we build and the world we live in," says Saxe. "When we build a specific type of infrastructure, it changes how we live. If we continue to build roads, this incentivizes people to drive more, creating more traffic and emissions. If we invest instead in transit systems and supporting density, we have better accessibility for more people."

Her central research question is ultimately, how do we make decisions around what we build to get to the society we're trying to achieve? The research focuses on understanding the relationship between urban infrastructure and societal scale sustainability goals, taking into account design, construction, operation, use, and policy.

"I often get asked the wrong question, 'what kind of infrastructure should we be investing in?' So my answer is always 'yes'. Yes we should be building all of them where they're appropriate. Context matters," says Saxe. "We need to be building the type of infrastructure that will support population growth of cities in a sustainable manner."

Saxe would like her research and work to move the needle towards building more ambitious civil infrastructure to support vibrant and sustainable cities. Two conditions must be met for cities and urbanization to be sustainable. First, the transport infrastructure being built must be the right kind, and second, cities must be effectively layering land use and infrastructure planning . Her research works to discern the best possible infrastructure planning and construction for sustainable cities.

There is no specific city that gets the infrastructure question perfectly correct, however many are doing well in specific aspects. The U.K. is publicly engaging with the question of which infrastructure to build and where. Los Angeles, due to it having a high vehicle-per-capita ratio, is making massive investments in transit. Vancouver and Montreal are both investing in bike lanes. In Copenhagen, more than half of daily trips made by residents are made on bikes.

The movement towards deliberate planning in cities is a trend Saxe welcomes and she hopes continues. Ideally, more energy will be put into working to improve cities for the future. She also noted one harmful trend in particular; the tendency to think that 'newer is better' when it comes to ideas about cities. There is a lot of pre-existing knowledge in this space that should be drawn upon.

PHD STUDENT RECOGNIZED WITH TOP U OF T TA AWARD

Pedram Mortazavi (CIV PhD candidate) is the winner of a 2018 TA Teaching Excellence Award from the University of Toronto's Teaching Assistant Training Program (TATP).

Mortazavi, a PhD candidate in the Department of Civil & Mineral Engineering, is one of just five recipients from more than 550 nominated teaching assistants (TAs) across the entire University. He has TA-ed Steel and Timber Design and, Principles of Earthquake Engineering and Seismic Design.

"It may sound cliché, but I love teaching," said Mortazavi. "TAs are a significant part of the student learning experience. I believe that the effect that instructors and TAs have on students goes far beyond the classroom. Beyond teaching the material, TAs play an important part as role models."

Mortazavi was nominated by several students of Steel and Timber Design, for which he was the Head TA. Even after the course was over, he found himself answering student requests for career and other advice.

"He learned all of our names and truly made himself available to students whenever they had a question," said Chris Rotella (CivE Year 3), one of the students to nominate Mortazavi. "He was very invested in the success of the students and even when an email came in at 9 p.m., he was happy to answer and help us."

"He checked in to make sure we all had the information we needed in order to complete our projects," continued Andrew Lau (CivE Year 3), another nominator. "When we couldn't figure out part of our model, rather than just provide the solution, he went back to the foundations of first year mechanics (CIV100) to explain how to fix the problem."

Mortazavi credits this recognition and his success in TA-ing to the course professor, Constantin Christopoulos (CivMin).

"Professor Christopoulos allowed me to contribute in a significant and meaningful way," explains Mortazavi. "I was able to plan and run the tutorials, lecturing the class from time to time and also defining the scope for the term project. It was because of these things that I felt that much more invested in the students and the course."

"Pedram was constantly thinking of progressive methods and clear ways to teach the course material," said Christopoulos. "He devised a teaching apparatus that replicates the physical behaviour of structural engineering components, which is often difficult to visualize."

> "I believe that the effect that instructors and TAs have on students goes far beyond the classroom. Beyond teaching the material, TAs play an important part as role models."

Mortazavi valued and implemented the feedback that he received from both Christopoulos and students.

"He proactively asked for advice and feedback about useful and effective teaching methods," said Christopoulos. "As a result, Pedram has developed excellent skills for encouraging students to participate in classes and tutorials."

Mortazavi is co-supervised by Professors Christopoulos and Oh-Sung Kwon (CivMin). His research — focused on the performance and experimental validation of cast steel link elements in eccentric braced frames — explores the idea that during an earthquake there is an element of a building that is engineered to absorb seismic energy and ensure that the remainder of the structure is undamaged, thus ensuring the safety of building occupants and first responders.

Mortazavi's research sees him working with U of T startup CastConnex and, alumni Michael Gray (CivE PhD 1T1) and Carlos de Oliveira (CivE MASc 0T6). He is also the President of the Earthquake Engineering Research Institute Chapter at the University of Toronto.

Mortazavi is the first student from Civil & Mineral Engineering to receive the TATP Teaching Excellence Award since it was created in 2003. The award seeks to value the work of TAs who regularly inspire and challenge undergraduate students. The awards committee considers the TA's knowledge of the subject area, communication skills, organizational skills, demonstrated enthusiasm, and ability to provide students with effective feedback, as well as testimonials from both students and faculty supervisors.

Survey CAMP:
A Department Tradition

Celebrating its 100th anniversary in 2020, Survey Camp is a long-standing Department tradition. After being acquired in 1919, the inaugural student group journeyed 200-kilometres north of Toronto for an unforgettable immersive field educational program in 1920. Today, as many as 200 Civil and Mineral Engineering students annually participate in the CAMP experience to better prepare them for their engineering professions.

After 100 years, the CAMP (Civil And Mineral Practicals) curriculum continues to evolve reflecting the changing requirements necessary for successful, skilled engineers. While surveying remains an important component there is also an emphasis on environmental, social, economic and sustainability leadership - inspiring students to effectively steward our planet now and in the future.

For students who attend CAMP today, the two-week field course consists of three modules: 1) full-scale construction layout for a highway curve; 2) full-scale topographic map development for the CAMP property; 3) water and energy aspects of sustainability and environmental engineering.

As the Department of Civil & Mineral Engineering deepens its expertise in hydrology, water chemistry, limnology, and mine tailings reclamation with Professors **Jennifer Drake** and **Lesley Warren**, Module 3 is undergoing a significant expansion with investment in 'Sustainable Water Resources'.

With a generous gift from the Dean's Strategic Fund, pontoon boats outfitted with a state-of-the-art acoustic doppler water velocity and bathymetric system, a new dock, water sampling equipment, portable spectrophotometers and waterproof temperature and oxygen meters, Guelph Permeameter kits, and other chemistry support packages will enrich the educational outcomes, providing leading-edge student-learning experiences.

These new assets will support a module focused on water management, water quality modelling, and holistic sustainable design. The focus of the module is an assessment of the quantity and quality of water in and around Gull Lake over time, providing data for modelling phosphorous loading modelling eutrophication risks. Student generated outcomes from this module may potentially contribute to the design of future CAMP expansion projects.

100 Years Young

To celebrate CAMP's Centennial, a $1.5M renovation plan has been approved to update and expand the Gull Lake site. Preserving the 100-year history of CAMP, the plan embodies the historic legacy while providing for our growing needs to educate the next generation of engineers.

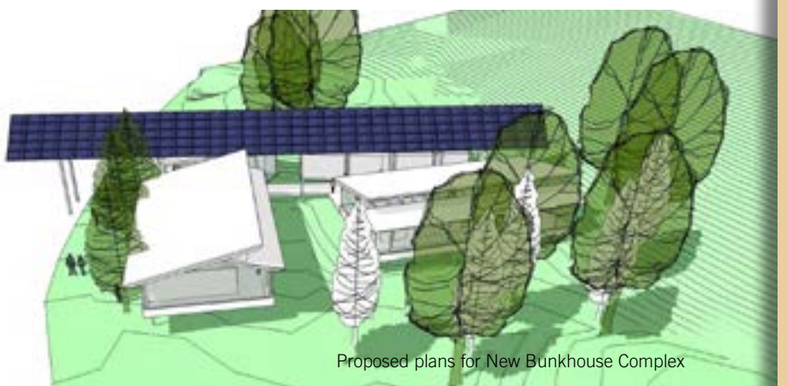
Key CAMP Restoration and Renovation Initiatives include:

- *New Bunkhouse Complex*: two bunkhouses with a separate bathroom and shower building and student common room, all connected with a covered boardwalk
- *Historic Bunkhouse Conversion*: in a second phase of the campaign, the original bunkhouse will be turned into the student hall for lectures, group study and special events
- *Water and Wastewater Infrastructure*: improvements and upgrades will be made to accommodate a growing student population
- *Additional Renovations and Repairs*: To preserve the CAMP legacy while providing safe space for new students and staff, a number of other projects have already been undertaken to address the staff sleeping quarters, cookhouse, roof replacements, window repairs, foundation work, and the installation of an emergency generator.

These initiatives address vital issues to support CAMP into the future including: providing greater accommodation for female students (who now make up over 40 per cent of the class at camp!) and an increasingly diverse population; provide a living lab for research initiatives, outreach programs and other educational programs during non-CAMP seasons; and protect and preserve the historic legacy of CAMP.

Construction is slated to begin in 2019 and we are approximately 65 per cent towards our $1.5M goal. The University of Toronto has shown its commitment to CAMP by offering a generous matching opportunity. Through this year, all gifts to CAMP will be matched dollar-for-dollar, up to $750,000.

In the Fall of 2019, we look forward to inviting all supporters, alumni and friends to a Centennial reunion celebration. Please check civmin.utoronto.ca for more information as it is available. Thank you in advance for your consideration and generous contributions. We are built on the unwavering support and donations from Department supporters like you.



Proposed plans for New Bunkhouse Complex

The Centennial Campaign for CAMP aims to raise $1.5 million to undertake much-needed renovations, repairs and expansion to the site. These comprehensive upgrades will be in keeping with the rustic tradition that makes CAMP unique, preserving the site's rich 100-year history while also serving the needs of a changing student population and educational landscape. All gifts to CAMP will be matched dollar-for-dollar, up to $750,000, by the University of Toronto.

Special thanks to everyone who has contributed to the campaign for CAMP to date:

Anonymous
Donald I Amos 5T8
The Association of Ontario Land Surveyors (AOLS)
John Bajc, 8T2
John Donald Barber, 6T2
Beacon Utility Contractors Limited
Robert A Beattie, 5T2
Wayne M Bennett, 6T9
Evan Charles Bentz, 0T0
Devon G and Linda J Biddle, 6T7
John A Bond, 6T8
Kenneth R Brown, 6T9
Buttcon Limited
W Brian Carter, 6T1
Arun Channan, 8T0
Bruce Chown, 5T5
So M Chiang, 0T0
Michael Circelli, 8T3
Classes of Civil 6T0 – 6T5 Campaign for CAMP
Class of Civil 6T8 for CAMP
Class of Civil 8T0 Campaign for CAMP
Class of 0T3 Engineering
Michael Cook, 6T3
Ralph Cowan, 6T8
Richard J J Daigle, 6T9
Ivan Damnjanovic, 1T5
B Michael den Hoed, 7T5
Peter F Di Lullo, 7T8
Vanessa M DiBattista, 1T2
Gregory Dimmer, 8T3
Paul G Douglas, 7T8
Henry N Edamura, 6T0
Marie-Anne Erki, 8T0
Leslie D Ferguson, 0T0
Wayne S Gibson, 8T3
Gordon Gracie, 5T2
Sheri Graham, 9T1
David H Gray, 6T8
Gull Lake Cottager's Association
Peter Halsall
Heavy Construction Association of Toronto (HCAT)
Walter J Hendry, 6T0
Alvin Ho, 9T8
Vera Y Kan, 0T0
William P Kauppinen, 6T8
Allan M Koivu, 8T6
TetsuoG Kumagai, 6T8
Ross Lawrence, 5T6
Arthur Leitch, 6T9
Robert MacGillivray, 8T5
Scott MacGillivray, 8T2
G Alexander Macklin, 5T5
William V Mardimae, 6T9
Orlando Martini, 5T6
Levana Mattacchione, 1T3
Brenda McCabe, 9T4
Lloyd McCoomb, 6T8
Malcolm McGrath, 5T4
Robert McQuillan, 5T0
Joel Miller, 6T5
Model Railings & Ironworks Inc
Ricky Junji Mori, 6T8
Loui Pappas, 8T8
PCL Constructors Canada Inc.
Kristin Philpot
Rob Piane
Victor Piscione, 7T5
Harold F Reinthaler, 7T7
Peter and Michelle Rhodes, 6T7
Glenn L Rogers
Senior Women Academic Administrators of Canada
Barbara Simpson
Amir Hossein Soltanzadeh, 9T5
Starkey & Associates Inc
D Wayne Stiver, 8T0
Emilio A Tesolin, 8T3
Umberto Testaguzza, 8T3
Michael V Thompson, 6T1
Sujitlal Thottarath, 0T6
Diego Tonneguzzo
Paul Walters, 5T6
Arthur H Watson, 7T5
Glen A Weaver, 5T2
Gabriel Wolofsky, 1T7
Gary J Woolgar, 6T1
Victor N Zubacs, 6T9

For more information, **alumni.engineering.utoronto.ca/camp** or contact Kristin Philpot at +1 (416) 946-7827 or kristin.philpot@ecf.utoronto.ca

BREAKING NEW GROUND AND TAKING TO THE SKIES

U of T researchers are finding new ways for civil and mineral engineers to use drones

Unmanned aerial vehicles (UAVs), or drones operating in the workplace is the future. In some ways the work environment is already changing in ways unimaginable just 10 years ago. At the University of Toronto, Department of Civil & Mineral Engineering, there are several professors and students developing innovative applications for drones. Drones could be deployed to aid courier deliveries; aid management of construction projects, assess the integrity of concrete structures, and optimize aspects of open-pit mining.

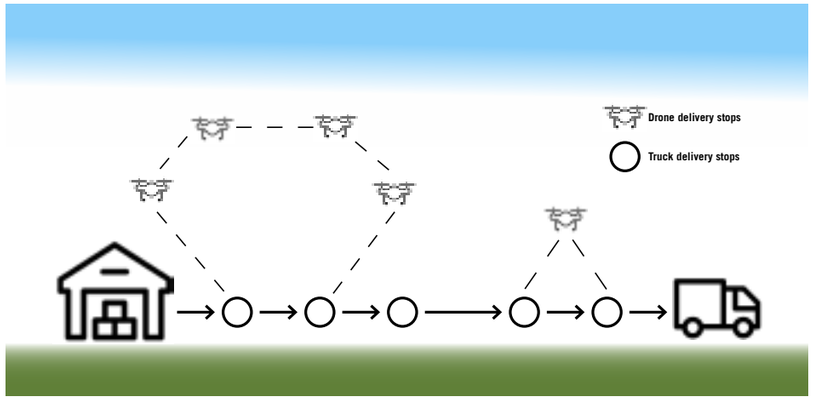
Online shopping has been growing in popularity due to its ease of use and convenience. For companies in this industry, cost-efficient shipping is an absolute necessity when there are high volumes of items to move. Minimizing the disruptions to traffic and the movement of people is important in dense urban areas like the Greater Toronto Area. It's a problem Professor Matt Roorda and Paul Deng (CIV MASc candidate) are tackling. Their project involves using drones to assist with multiple deliveries made by trucks.

Picture this: a delivery truck drives a route while several drones pick up packages from the truck, deliver them and return to the truck to pick up and deliver more packages, all without the truck needing to stop. It's an ideal, but highly complex scenario.

Deng is currently working to solve the vehicle routing problem (VRP) by mathematically optimizing the route planning process. The ultimate goal of Deng's research is to find a heuristic solution – one which finds the optimal balance between cost, distance travelled, and time for delivery.

Solving the VRP incorporating drone technology has several benefits such as more efficient deliveries, but one of the most significant effects is on traffic congestion in cities. Though illegal in many cities, issues persist with delivery trucks parked in bike lanes and blocking lanes reserved for rush-hour traffic. This project would enable delivery trucks to continue along their route without needing to park.

While stories about drone delivery have been appearing increasingly in the news, drone use is appearing in less mentioned industries as well. In the construction industry, automation is all around but not always obvious. In factories and warehouses the manufacture of materials and assembly of building components takes advantage of high tech processes like using robots for automation and precision. Construction environments, however, pose significant challenges to automation: they are busy, exposed to the elements, and are constantly changing, with multiple crews working at different times in different places, creating both logistical and safety challenges. Construction managers need to keep the project moving forward by updating the project plan, which has seen very little in terms of leveraging newer technologies. Professor Brenda McCabe and her team are looking to address this.



Possible optimized delivery route for a drone to follow

Professor Brenda McCabe with a drone in front of the construction of the Myhal Centre for Engineering Innovation and Entrepreneurship (Credit: Roberta Baker)

This project started four years ago with assistance from Hesam Hamledari (CIV MASc 1T6). Schedule updating is a time consuming but ultimately necessary task related to managing a construction site. McCabe came up with an idea to innovate the process of progress analysis and data capture with a drone. UAVs can be used during off-hours to capture images that are then analyzed and used to assess construction progress. First, the project manager identifies which locations and which construction processes (i.e., framing, electrical, painting, etc.) need to be inspected. At a pre-determined time, the UAVs follow an efficient path based on a 3D building informational model (BIM). UAVs take photos along their scheduled paths and download the images to a computer. Though research is still in progress, the concept is that a series of algorithms will be used to extract critical information from the images about the progress of work, which is in turn used to automatically update the project schedule with little or no human intervention.

The most significant challenge for this project right now is the need for a reliable indoor navigational system. One idea is to incorporate AprilTags (similar to QR codes), which are directionally associated, interfaced with the BIM, and placed strategically to guide the UAV through the site. The incorporation of UAVs into the process of data capture and progress analysis is part of the growing trend towards automation for efficiency. By optimizing this process, McCabe and her team are seeking to significantly improve the scheduling ability of project managers.

Inspection of structures located in hazardous environments is a challenging problem. Professors Doug Hooton and Karl Peterson are in the early stages of developing a multi-drone, fully-automated monitoring solution for industrial sites, specifically decommissioned nuclear plants. The goal is to create a more efficient way to monitor the integrity of concrete structures without exposing inspectors to radiation, while also saving time and money.

One of the project's objectives, which is similar to one of the challenges McCabe faces, is to develop methods to localize drones with high accuracy indoors and outdoors, and in cluttered industrial spaces. In outdoor applications, the drones encounter variable wind and weather conditions and must compensate to provide a stable platform. Hooton and Peterson intend to use a combination of GPS and a low energy, short-range, high-bandwidth radio technology called ultra-wide band (UWB). A second challenge is to adapt or develop lightweight sensors to assess structural integrity of concrete structures with capability to detect cracks, moisture, and thermal leakage in the concrete. This may be a challenge due to the weight of the sensors and battery constraints of both the UAV and the attached sensors.

Professor Kamran Esmaeili is also looking for ways to increase efficiency and safety using drones. Esmaeili's project is focused on using drones to collect data that can be used to optimize part of the mining process; specifically, data acquisition from the drill and blast process, blasted muck piles, pit wall and heap leach mapping and monitoring. His guiding question is: 'How can drone technology be used as a flying lab to collect data useful for mining optimization?'

With his research team of Thomas Bamford (CIV PhD Candidate, MIN 1T4+PEY), Filip Medinac (CIV MASc Candidate, MIN 1T2) and Mingliang Tang (CIV MASc Candidate, MIN 1T8), and using a DJI Matrice 600 Pro drone with multiple attached sensors (photogrammetry and thermal cameras, LiDAR), they are developing solutions for real-time, on-demand, high-resolution data acquisition and decision making. With Esmaeili's work, localization isn't a problem. He's able to use GPS satellites to orient the drone because the focus is applications in open pit mines. However, he's already thinking about moving this technology into underground mines and the potential challenges this brings. Since underground mines are GPS denied zones (since they lack sufficient satellite coverage), he has some ideas on how to localize the drones. In particular, using laser or sonar sensors might address that problem.

Each of the projects discussed explores some of the applications that may be possible in the future. Engineers with the Department of Civil & Mineral Engineering have partnered with Angela Schoellig (University of Toronto Institute for Aerospace Studies) to address some of the challenges related specifically to drone technology and capabilities.

Drones are changing our world, affecting the way we live and work. They have immense potential to create safer and more efficient work environments. There are still limitations, the most significant being battery life and federal regulations. As drones become more sophisticated and as aviation regulations are revised, it is likely that we will see more engineering applications for UAVs.

Kevin Floether

Drone onsite at a quarry (Credit: Kamran Esmaeili)

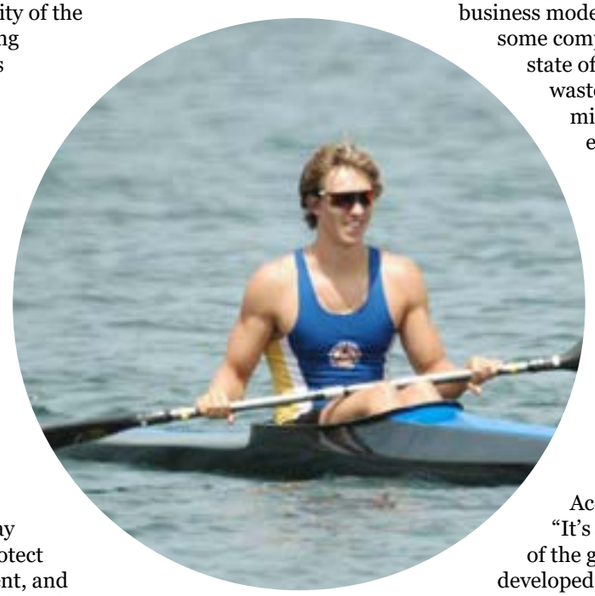
TOMORROW'S GLOBAL ENGINEERING LEADERS

CONRAD HOPP

Due to Earth's growing population, the UN estimates that 55 per cent more fresh water and 80 per cent more energy production will be needed by 2050 to accommodate demand.

Canada is fortunate to have nine per cent of the world's fresh water yet, we often take our water for granted. With the majority of the Canadian population growing up in cities, water scarcity is not always top-of-mind.

That's not the case for Conrad Hopp (MIN 1T8). Growing up in Toronto's east-end neighbourhood, the Beaches, he's been around water from a young age. Hopp was brought up in a household with an interest in the environment. He chose the Lassonde Mineral Engineering Program at the University of Toronto because of its academic focus, his desire to find a way to apply his education to protect and improve the environment, and because of the unique lifestyle and culture of professionals in the mining industry.



"One thing that's always struck me about mining is the huge waste side of it," says Hopp. "If you think about the production of gold ore you get one gram of gold per tonne of waste. On top of the solid waste is all the process water that has to come out of it, which can consume 100-600 cubic metres per hour of fresh water resources. It was something to me that was pretty shocking. I thought, there must be a more efficient and effective way to deal with this."

"I can't speak highly enough about the Department," continues Hopp. "The members of the Department were really accommodating and understanding, allowing me to pick my schedule to accommodate being part-time, and allowing some flexibility to pick my thesis topic."

His undergraduate thesis examined the merits of electrochemical wastewater treatment as an alternative to traditional methods, highlighting the potential to provide economic and environmental benefits to the mining sector. The electrochemical treatment process involves the generation of ionic coagulants by the electrolytic oxidation of a sacrificial electrode, which is consumed during the treatment process. The coagulants aid in removal of contaminants from wastewater, allowing the water to be safely discharged into the environment. Keeping this process on site and not involving any additional chemicals lowers the economic costs for the treatment of wastewater.

Hopp attended the June 2018 BlueTech Forum in Vancouver. This year's topic was managing water risk in a circular economy – an economy aiming to eliminate waste by developing innovative products and business models. Here he came across some companies who have developed state of the art technologies for wastewater treatment that minimize both cost and environmental impact. He was surprised to learn these companies don't do customer demonstrations in Canada. This is due to one of the biggest challenges confronting the commercialization of industrial wastewater treatment, which is a lack of incentives pushing companies to institute effective technologies.

According to Hopp, "It's a shame – many of the great technologies developed by Canadian entrepreneurs have to end up taking their technologies abroad to see success, especially with the abundance of industrial processes that produce wastewater here in Canada."

Hopp says the Canadian government is doing a good job by incentivizing research and development, but lacking when it comes to creating the market drivers required for technologically advanced projects to thrive in Canada. Increasing the strength of water regulations and supporting technology commercialization would go a long way to improving this. Improving these market drivers would not only help Canada economically, but also environmentally, by creating further incentives rather than penalties for companies to clean up their waste.

Hopp is currently working independently to further his research on wastewater treatment. In the future, he would like to work with an industrial partner in the mining industry to tackle a niche contaminants and improve wastewater treatment methods for the industry as a whole.

See page 35 to read more about Hopp's work.

Some of our 2017-18 Lassonde Scholars: Roy Singh, Marko Lopac, Joana Azubalis, Paige Clarke, Mingtiang Fang, Ognjen Kelec, Marc Umanec, Peng Yang, Yilin Zhao, Feung Liu, Yu Feng, Stanaj Gill, Pierre Lassonde, Jing Bai and Seung Baek.

2017-2018 LASSONDE MINERAL ENGINEERING & INSTITUTE HIGHLIGHTS

Another memorable year is in the books for the Lassonde Mineral Engineering Program students and recent alumni. Taught by world-recognized educators, top Lassonde Institute researchers and industry experts, 2017-18 has a been a busy time with many successes and new opportunities.

The Lassonde Institute has undergone a comprehensive re-imaging to create one globally connected community that will deliver next generation innovations, transformative industry solutions and engineering leaders. The Department of Civil & Mineral Engineering and the Institute sets out to be a global leader in mining education, industry relevant research and a forum for knowledge exchange and impact.

ABOVE — Professor Lesley Warren (Director, Lassonde Institute), Dr. Pierre Lassonde and Speaker Zita Cobb pose at the Lassonde Institute's 2nd Pivot Point Event.

RIGHT — In Toronto's Distillery District, over 120 alumni and industry guests gathered for the sold out event.

LASSONDE ALUMNI & INDUSTRY CONNECTION

What does it take to pivot an industry? What does it take to change minds and spark creative conversations for transformation? It starts with gathering the community, all perspectives; from industry, government, academic, NGO's and other community leaders for a collaborative moment to discuss where we can go next.

The Department of Civil and Mineral Engineering's Lassonde Institute is creating that moment for the entire mining community, here in Toronto and this fall in Vancouver. The Lassonde Pivot Point Event Series is a forum for exchanging breakthrough ideas. Uniting experts and industry, and crossing traditional boundaries, the Lassonde Pivot Point's catalytic action powers

exceptional thought leadership to advance the Canadian mining community's resilience on a global scale.

Hand-in-hand with industry veterans, disruptive business leaders and Lassonde researchers, the Lassonde Institute sets out to be an integral part of the bedrock of mining's future

We know we are in the midst of significant disruption across a number of aspects for the mining industry and in a recent project with Monitor Deloitte, the Lassonde Institute looked at a number of challenges including:

- *Regulatory* – increasing demands from government through taxation, transparency expectations, focus on economic development; uncertain royalty regimes; political instability;

- *Social* – evolving and expanding stakeholder relationships, changing social contracts; delivering on social impact and integrated social responsibility;
- *Environmental* – reducing energy consumption and freshwater needs, cleaner energy sources such as renewables, increasing transparent reporting and meeting expectations;
- *Technology* – automation; AI and machine learning; new hauling technologies; blockchain advancements;
- *Talent* – new required digital and technological skills; retraining and upskilling the current workforce and the creation of new career paths; redesigning the workplace for machine-human collaborations.

Tackling the new disruptive challenges set to pivot the mining industry, our upcoming national events, will pose provocative questions to spark conversations for real-word impact.

The Lassonde Pivot Point Event Series, launched in October 2017, builds upon previous thought leadership talk events with Rob McEwen (2017), Jennifer Maki (2016) and Bob Rae (2016).

Our first Pivot Point event, presided over by **Pierre Lassonde** as Master of Ceremonies, welcomed over 90 invited guests in The Toronto Club's grand ballroom to hear **George Hemingway**, Partner and Head of Innovation Practice at Stratalis Consulting based in New York City.

Hemingway's keynote entitled "Unstoppable Force. Immovable Objects." challenged guests to rethink the definition of mining and with that the entire industry make-up.

LEFT — Alumni Henrique Coppini (MIN 1T4 + PEY) and Channa Kumarage (MIN 1T5 + PEY) take in Zita Cobb's lively presentation.

BELOW LEFT — Industry veterans John Starkey (MIN 6T1) and Ian Pearce (Newport Gold Board Director) discussing the importance of community with David Harquail (CEO of Franco Nevada)

BELOW RIGHT — George Hemingway presented a Pivot Point Campus Edition, seen here with 4th year LME students.

Positing an 'Unstoppable Force' bearing down on the mining industry is change itself, Hemingway aptly stated: "The miners of the tomorrow will not resemble the miners of today. New competitors may emerge from the most unlikely of places and bring with them new rules for mining business success. Will the hottest tech start-up or an Internet behemoth be poised to take over the industry or will their mere presence redefine how it means to operate?"

Hemingway challenged the Pivot Point attendees to not become the 'Immovable Objects' themselves using foresight (a wide lens to view today's and tomorrow's landscape), flexibility (the ability to adapt and innovate) and focus (without being distracted and deterred by the unexpected) to overcome a world in which all of us must be prepared to pivot.

In April 2018, the Institute's second Lassonde Pivot Point took place in Toronto's historic Distillery District at the Thompson Art Gallery. A place of Canadian culture and innovative design, over 120 attendees from industry and academia gathered to hear a titan of disruptive entrepreneurship, Fogo Island's **Zita Cobb** deliberating the mining industry's "Most Unexpected Resource: Community".

Challenging the way that industry solves problems, Cobb stressed the importance of identifying problems in community and finding solutions through community. In isolation, industry cannot build a resilient mining industry if stakeholders in and beyond the traditionally defined mining industry do not work together. For sustainable success, Cobb argued that an interconnected, collaborative network comprehensively representing all ideas, expertise, experiences and perspectives is the only way forward for real-world mining transformation.

Check out **lassondeinstitute.utoronto.ca** for more information and to request an invitation for our upcoming events.

WINNING OPPORTUNITIES:

TEAM LASSONDE COMPETES ON NATIONAL & INTERNATIONAL STAGES

THIS PAGE — Romy Dome and Ice Peerawattuk answer industry judges' questions at the 2017 World Mining Competition.

OPPOSITE FIRST ROW — Mark Umanec, Ice Peerawattuk, Marko Lopac and Dalton Veintimilla accepting their first place winnings at the 2018 Goodman Gold Challenge in Sudbury

OPPOSITE SECOND ROW — Team Lassonde at the World Mining Competition receiving their 3rd place trophy in Calgary, AB.

The Lassonde Mineral Engineering (LME) Program is a comprehensive curriculum with both applied and practical educational experiences taught by globally recognized professors and industry experts. Throughout the four-year journey students test theory and participate in hands-on learning in state-of-the-art labs, field environments, mine site visit, and special industry guest lectures. Students also can participate in the Professional Experience Year Co-op program, unique to the Faculty of Applied Science and Engineering at the University of Toronto.

For those students looking to flex their engineering knowledge and stretch their critical thinking abilities, student design and case study competitions are a way to demonstrate industry relevant skills. This year, our LME students showed their abilities to industry judges with great success at the World Mining Competition and the Goodman Gold Challenge.

2017 World Mining Competition

Finishing third in the World Mining Competition held in Saskatoon, Saskatchewan the LME students tested their business, geology and engineering knowledge to develop their solution to the case study challenge. Competing among 50 delegates, over 10 schools from across four countries, Team Lassonde represented the Department of Civil & Mineral Engineering proudly.

2018 Goodman Gold Challenge

Facing competitors from the Schulich School of Business, Laurentian University, Queen's University and the University of Kentucky, the LME team won first place in the 2018 Goodman Gold Challenge in Sudbury.

The Goodman Gold Challenge is a hands-on investment mining competition for business, geology and mining students across North America. Applying their academic course work, students gain real-life experience interviewing three gold mining company CEOs on their respective current and future financial standings. The gold companies, currently trading on the TSX or TSX-V included: Wesdome, Nighthawk Gold Corp, and Sabina Gold & Silver Corp. Upon evaluation, each team recommended the gold company they thought would provide the best potential investment opportunity.

The winning 2018 LME team members Mark Umanec, Ice Peerawattuk, Marko Lopac and Dalton Veintimilla presented their recommended investment deck to a panel of experts from RBC Global Mining & Metals Group, Kinross Gold, Canaccod Genuity, MNDM and Paul Martin, President & CEO of Detour Gold along with David Harquail, President & CEO of Franco-Nevada.

"We want to thank Mike Chen (MIN 1T4) for helping us get Waterton Global Resource Management to sponsor our team financially and also giving us the chance to present our pitch to them and get feedback before we competed."
– 2018 LME Team for the Goodman Gold Challenge

To read about the latest Team Lassonde Student Competition wins check **civmin.utoronto.ca/news**

SPOTLIGHT ON ALUMNI

Robert Roponi, PEng
TR Roponi Consulting Ltd
GEO 8T4

The legacy of Mineral Engineering at the University of Toronto is long-standing though its name had changed over the years (see page 8 for a timeline). From its beginnings as Assaying and Applied Geology (1878) to Mining Engineering (1892-1964) and Geological Engineering (through the 60's -90's) to Mineral Engineering today, the list of our alumni is deep.

Thirty four years after his graduation, we had the pleasure of speaking with Robert Roponi GEO 8T4 about his time during and after his undergraduate experiences.

Why did you choose Geological Engineering at U of T?

Choosing universities in 1979 was very different than today with no University fairs and of course, no internet. U of T had the best engineering program in the Toronto area. Initially I did not get into U of T as somehow my grade 13 physics mark did not get sent with the rest of my marks. After a series of phone calls to the registrar, I had the missing marked mailed and got late acceptance!

What is your first memory at U of T?

Professor Chaffee was very dedicated and went out of his way to make sure that we had every opportunity to succeed. He taught us first year chemistry and computer programming. University was a big transition from high school and we were told right away that a lot of first year students wouldn't make it through the entire program. Having professors like Dr. Chaffee brought some encouragement when the workload seemed like too much.

What was you first job after graduating?

1984 was a tough year for engineering graduates across the board. I had one job offer which Professor McAndrew was able to arrange at a potash mine that was part of the Noranda group in Saskatchewan. Unsure about the position, I was told that as opportunities opened up elsewhere in the group, I could transfer. The mine went into a summer shutdown shortly after I started due to depressed potash markets so I spent the summer on what was called "fire watch" making sure the plant was safe and ready to operate. Once we were back in production I did everything from lab work to an operator on special projects. The experience was very hands-on and a good way to start my career.

Briefly, what has been your professional trajectory?

I spent the first 10 years of my career in operations. I worked at two gold mines after leaving Saskatchewan (Yellowknife and Hemlo in north-west Ontario). Working at the Williams Mine in Hemlo was a highlight of my operational career. It was the largest gold mine in Canada at the time and I got to oversee some great projects which improved operations, reduced costs and increased gold production. The next 10 years of my career were spent in engineering with SNC-Lavalin after they acquired Kilborn.

One of the main things I came away with in this phase of my career was the importance of process development from initial sample testing all the way to the design, construction and commissioning of a process plant. I was the lead process engineer on the construction of the first phosphate concentrator in Canada. My operational and design experience allowed me to become an expert in the recovery of gold. The next 11 years of my career were in the corporate office of a medium size gold producer with operations in Central Asia at the time. My role was focused on optimizing the operations and project development. I received two CEO awards during my time there in these areas.

I am now a successful independent consultant. My operational and project development background provides me with skills in high demand in the mining industry currently.

Speaking from your experiences and your successful career, in your opinion what trends, areas or important issues must the mining industry face in the next generation?

There is shortage of trained engineers both for operations and project execution. When the markets pick up and the pressure to build new projects resumes, the industry will need well-trained individuals. The mining community has not done itself any favours over the years by laying off many workers during periods of low metal prices. Many leave the industry and never return. In my discussions with students and young engineers, I stress the importance to gain hands-on experience in operations. This kind of experience is invaluable for careers and future advancements.

Any other points of note you would like to share with our current students and future graduates?

I can't emphasize how important building relationships is in the mining business and in general. My relationships and reputation are some of the key assets that have allowed me to succeed as an independent consultant. Getting out and networking is an important part of building your career. Using social media is a good tool in this effort but you can't replace face to face encounters and discussions. There is nothing more genuine than engaging in discussions with another person face to face, you simply can't build the relationships or accelerate your career any other way.

Thank you to Robert for his time and insights. If you would like to provide an update to the Department or get featured in an upcoming Alumni Spotlight please send your information to civ.communications@utoronto.ca.

New LME Graduate.
New Company.
New Wins and Opportunties.

Conrad Hopp, a recent graduate from the Department of Civil & Mineral Engineering's Lassonde Mineral Engineering program, travelled down to Brazil in July with the Aquova team winning the Nexa Resources Circular Economy Innovation International Challenge.

As the co-founder of Aquova, along withe fellow UofT alum, Essam Elashawi (ECE PhD Candidate), Hopp has built a successful start-up specializing in intelligent active electrochemical wastewater treatment system (AEMS) solutions for Canadian gold mining companies. Through patentable hardware and software leveraging real-time control procedures to enhance the performance of electrochemical plants. Aquova's technology increases energy efficiency and reduces costs for industry focusing on sulphates and cyanide based complexes.

Hopp and Elashawi's Aquova are also among the top finalists in MIT's Clean Energy Prize, an international, student-run business plan competition aimed at solving some of the next generation global energy challenges.

To learn more about Aquova please visit their page on Linked In and click follow their page to keep up to date with this impressive LME student start-up.

MASTER OF ENGINEERING IN CITIES ENGINEERING AND MANAGEMENT

HIRE THE NEXT GENERATION OF URBAN ENGINEERS

MASTERS STUDENTS ARE SEEKING SUMMER PRACTICUMS

> “Being involved in transportation infrastructure projects like the Gordie Howe Bridge helps to understand international competition between cities and countries, and how infrastructure-related trends shape urban landscapes. Specifically, I’m looking at how Detroit and Windsor compete and compare for people, goods and commerce.”

Bilal Yusuf
MEngCEM Practicum 2016

> “The work I’ve done for Yukon Highways and Public Works ties directly into key CEM program concepts: real-life modelling, budget allocation to achieve maximum efficiency and ITS planning to improve effectiveness of road networks.”

Sarah Dominie
MEngCEM Practicum 2016

Transportation, utilities, housing and waste management are systems that every city needs to function efficiently or they can hinder the life of the city. The elite MEngCEM (Master of Engineering in Cities Engineering & Management) program gives students a unique combination of technical expertise in infrastructure and a fundamental understanding of the cross-disciplinary issues facing cities.

The program admits a small number of students, who all have at least one year of professional experience. By hiring a student for a four month placement, your organization is getting more than a summer intern, you will be getting a student who can contribute in a meaningful way from day one. Hiring organizations can also benefit from a tax credit.

If you think there might be a role for an MEngCEM student with your organization, please contact **civ.gradprograms@utoronto.ca** for more details.

#MYPEY PROFESSIONAL EXPERIENCE YEAR

Have you considered hiring a PEY Co-Op Student?

It's free

No fees when you register to our Career Portal.

Tax credit letters

Ontario employers may be eligible for a tax incentives worth up to $3,000.

Recruitment support

We provide resources to support you with recruitment, job posting and interview scheduling, as well as providing on-campus interview space.

One-on-one meetings

Let's discuss your specific recruitment strategies, and how the PEY Co-op program can support your needs.

More details at
engineeringcareers.utoronto.ca

U of T Engineering's Professional Experience Year (PEY) internship program is the most highly regarded paid internship program in Canada. 3rd and 4th year students are placed for 12 to 16 month - an excellent way for your company to access and recruit some of the world's brightest future engineering leaders.

UPCOMING EVENTS

Receive notices about these events and others through the CONNECT platform

uoftengineeringconnect.ca

CivMin Awards Reception

Honouring student award and scholarship recipients

October 2018

Skule™ Lunch & Learn

Resilience - Constantin Christopoulos

December 5, 2018

CivMin Career Fair

Organizations exhibit and recruit students and recent graduates

January 2019

Iron Ring Ceremony and Reception

Graduating students receive their iron rings

March 2019

Alumni Reunion

Come back to Skule™
Honoured years ending with 4 and 9

May 29 - Jun 2, 2019

Please check website for calendar updates and new events.
civmin.utoronto.ca

Luis Bettencourt

Pritzker Director - Mansueto Institute for Urban Innovation
University of Chicago

Susan Harrison

Department of Chemical Engineering
University of Cape Town, S. Africa

Arpad Horvath

Lawrence E. Peirano Professor of Civil and Environmental Engineering
UC Berkeley

Lut Raskin

Department of Civil and Environmental Engineering
University of Michigan

2018-2019 DISTINGUISHED LECTURE SERIES

Please check website for dates, lecture abstracts and additional speakers
civmin.utoronto.ca/lectures

CONNECT
uoftengineeringconnect.ca

DONATE
uoft.me/supportskule

VOLUNTEER
uoft.me/skulevolunteer

We wish to acknowledge this land on which the University of Toronto operates. For thousands of years, it has been the traditional land of the Huron-Wendat, the Seneca, and most recently, the Mississaugas of the Credit River. Today, this meeting place is still the home to many indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.

UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING