DEPARTMENT OF CIVIL & MINERAL ENGINEERING
University of Toronto

DEPARTMENT MAGAZINE, ISSUE 24
Fall 2019

foundations

EQUITY, DIVERSITY, INCLUSION, ACCESSIBILITY

A CONVERSATION ABOUT THE ROLE OF ENGINEERS

Also in this issue:
Get a sneak peek of the plans for the new buildings at Survey Camp

Civil & Mineral Engineering
UNIVERSITY OF TORONTO

Correction: In the Fall 2018 issue of The Civilian, in the article titled *Spotlight on Alumni*, Robert Raponi's name was spelt incorrectly. We sincerely apologize to Mr. Raponi for this error.

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MESSAGE FROM THE CHAIR

Some of you may have expected to receive a different magazine in your mailboxes this fall. As I mentioned in the last magazine, that was the last issue of our magazine titled *The Civilian*. Since changing our Department's name to Civil & Mineral Engineering, we wanted to rename our magazine to better represent our community. So, I am pleased to present *foundations* magazine. Whether it is a geological term, a component of a building or the idea of learning the fundamentals of science and engineering, the magazine name represents a solid base for us to build on and grow our interactions with the world around us.

Over the past academic year, our department took part in a regular accreditation process with Engineers Canada. We were delighted to hear that both of our undergraduate programs were granted accreditation for the next six years – the maximum number of years possible. The accreditation process and our 2017 external review carries us into a phase where we are working on a five year strategic plan. We are looking forward to enriching our existing programs, including our Master of Engineering program. We believe this kind of growth will benefit both our students and the industry as a whole.

While this past year had many positive moments and successes, we were saddened to lose a member of our community, Anand Baiju, who passed away as a result of a tragic accident while attending CIV201 (Introduction to Civil Engineering) in September 2018. To honour his memory, our Department will be establishing a scholarship in his name and installing a permanent monument to him at the Survey Camp property on Gull Lake.

It seems this summer has sped by and the fall term is now upon us. The first days of the fall term are always exciting here with the campus buzzing with the new cohort of enthusiastic undergraduate and graduate students joining us. This fall, we will have 100 Civil Engineering students and 40 Lassonde Mineral Engineering students joining us. We will also have an impressive group of 75 incoming research stream students (PhD and MASc) doing research with our faculty members and over 85 students beginning their studies in the professional stream (MEng and MEng in Cities Engineering and Management).

On the teaching and research side, Professor David Taylor joined us in January 2019. David is a graduate of the Energy Systems option in Engineering Science at U of T and completed his PhD at MIT. David is cross-appointed with the Centre for Global Engineering. His research focuses on urban water distribution infrastructure and specifically how this infrastructure behaves in Mega Cities in the Global South. You can read more about his research in the feature article in this issue. You can also meet David at his November 13 Skule™ Lunch and Learn lecture. In January 2020, Dr. Sebastian Goodfellow will join the Department. Sebastian completed his PhD in Civil and Mineral Engineering with a focus on rock fracturing processes. He is currently applying his expertise in machine learning and data science with KORE Geosystems and also with the Hospital for Sick Children. We look forward to Sebastian joining us, bringing strength in geophysics and data science to our teaching and research activities.

In this issue of *foundations* our cover story focuses on the role of engineers in equity, diversity, inclusion and accessibility. Not only are we becoming more diverse as a profession, but we have a duty to consider these factors in everything we do as engineers. Our stories highlight some activities within the Department in providing equal access to safe, affordable and resilient housing, and in developing transportation infrastructure policies. We also provide perspectives on the benefits of increasing diversity in the mining industry and on inclusiveness in engineering. I note that our incoming class is between 33 and 41 per cent women and more than 25 per cent of our faculty in the Department are women. I herald the efforts of our former Dean, Cristina Amon, in advancing equity, diversity, and inclusion in the Faculty and look forward to working with our new Dean, Christopher Yip, in this area, as well as Marisa Sterling, the new Assistant Dean and Director of Diversity, Inclusion and Professionalism.

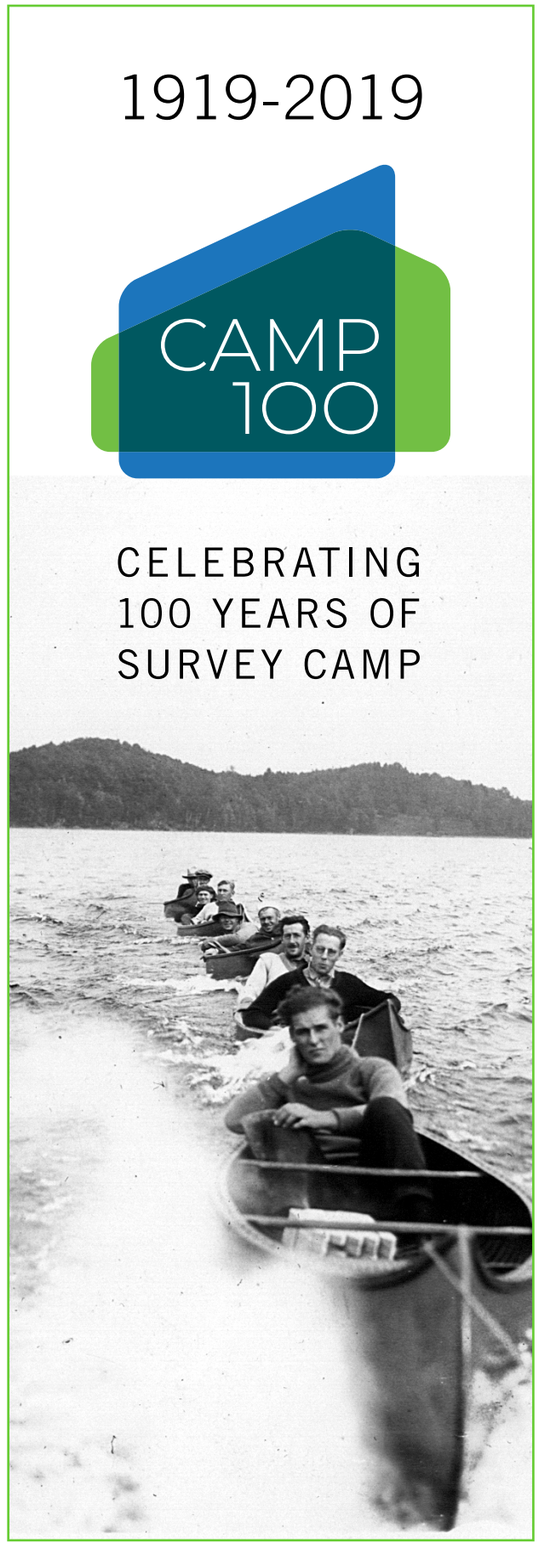
I am excited that we are able to provide details of the plans for new buildings at the Gull Lake Camp. By the time you open this magazine, we will have held our celebration to mark the 100th year of Survey Camp at U of T. Yes, 100 years! This celebration will also have marked the official launch of the construction project to build a new bunkhouse and common room at Camp. These new buildings are badly needed to accommodate the changing demographics of our undergraduate student cohort, as well as newer uses of the Camp including the DaVinci Engineering Enrichment Program (DEEP) Leadership Camp. The tremendous generosity of our alumni who are supporting this construction project is deeply appreciated.

In this issue we continue to feature articles on the achievements of alumni of the Department. You can also check out the awards our staff, students, and alumni have received over the past year. We'd love to hear of your achievements so we can highlight them in the next issue of this magazine, on our website, or on our CONNECT platform.

I invite you to provide your thoughts or questions on any of the articles in this issue. I hope to see you at one of our Department events in the upcoming year, from our Distinguished Lecture Series to the Alumni reunion next spring.

Brent Sleep

Professor Brent Sleep



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Originally published in The New York Times | Opinion

WHAT WE REALLY NEED ARE GOOD 'DUMB' CITIES

Sensor-equipped garbage cans sound cool, but someone still has to take out the trash

TORONTO — Like a classroom full of overachieving students, cities around the world are racing to declare themselves "smart" — using sensors, data and ubiquitous cameras to make themselves more efficient, safe and sustainable. Perhaps the most famous initiative is here in Toronto, where Sidewalk Labs, a sibling company to Google, recently released a 1,500-page master plan to remake two neighborhoods with things like snow-melting roads and an underground pneumatic-tube network.

Smart cities make two fundamental promises: lots of data, and automated decision making based on that data. The ultimate smart city will require a raft of existing and to-be-invented technologies, from sensors to robots to artificial intelligence. For many this promises a more efficient, equitable city; for others, it raises questions about privacy and algorithmic bias.

But there is a more basic concern when it comes to smart cities: They will be exceedingly complex to manage, with all sorts of unpredictable vulnerabilities. There will always be a place for new technology in our urban infrastructure, but we may find that often, "dumb" cities will do better than smart ones.

As we know all too well from our personal lives, tech products have a short reliable life span. We accept regular disruptions in internet and cellphone function as a fact of life. Technology ages rapidly, with glitches increasing common only a couple of years into its life.

But would we accept the same rate of disruption in, say, our water and power services? City infrastructure, especially in high-income countries, is designed to last decades or centuries and must always work. Bridges are built to last 100 years, tunnels longer.

New technology in 2015 will be outdated before 2020. If we widely deploy smart tech in cities, we need to be prepared to replace it every few years, with the associated disruption and cost. But who will assume those costs?

Assuming these upgrades take place in a democratically run city, who can guarantee that future elected leaders, in an effort to cut costs and appease taxpayers, won't shortchange spending on replacement technology — which, after all, might take place long after they leave office?

Cities must also plan for the inevitable moments when the sensors fail no matter how often we maintain or replace them. Failures in engineered systems tend to come at the most inconvenient times, like when a storm drops high levels of water and simultaneously knocks out the electricity to a smart storm water management system.

Managing all the sensors and data will require a brand-new municipal bureaucracy staffed by tech, data-science and machine-learning experts. Cities will either need to raise the funds required to pay a tech staff or outsource much of their smart city to private companies. Since current average salaries for tech workers are typically higher than for public employees, such a bureaucracy is likely to be expensive. If the answer is to outsource that staffing to private companies, then cities need to have frank conversations about what that means for democratic governance.

The most critical question, however, is whether having a smart city will make us meaningfully better at solving urban problems. Data and algorithms alone don't actually add very much on their own. No matter how much data a city has, addressing urban challenges will still require stable long-term financing, good management and effective personnel. If smart data identifies a road that needs paving, it still needs people to show up with asphalt and a steamroller.

For many urban challenges, effective analog — "dumb" — solutions already exist. Congestion can be tackled with autonomous cars, true; it can also be tackled with better railways, bus rapid transit and bike lanes. Houses can be covered in sensors to control an automated heating and cooling system; they can also be built with operable windows and high-quality insulation.

And public garbage cans can be emptied when sensors say they are full, or on a regular basis, based on the expertise of experienced, well-paid city workers. Smart solutions might be exciting, and they might seem cheaper in the short run, but that alone doesn't make them better.

As an infrastructure engineer, I seek the simplest effective solution to a problem with a minimum of negative consequences. What will be durable and effective over the long term? Tech solutions to urban challenges are often a Rube Goldberg machine, a fun but unnecessarily complicated approach to solving challenges with more direct solutions.

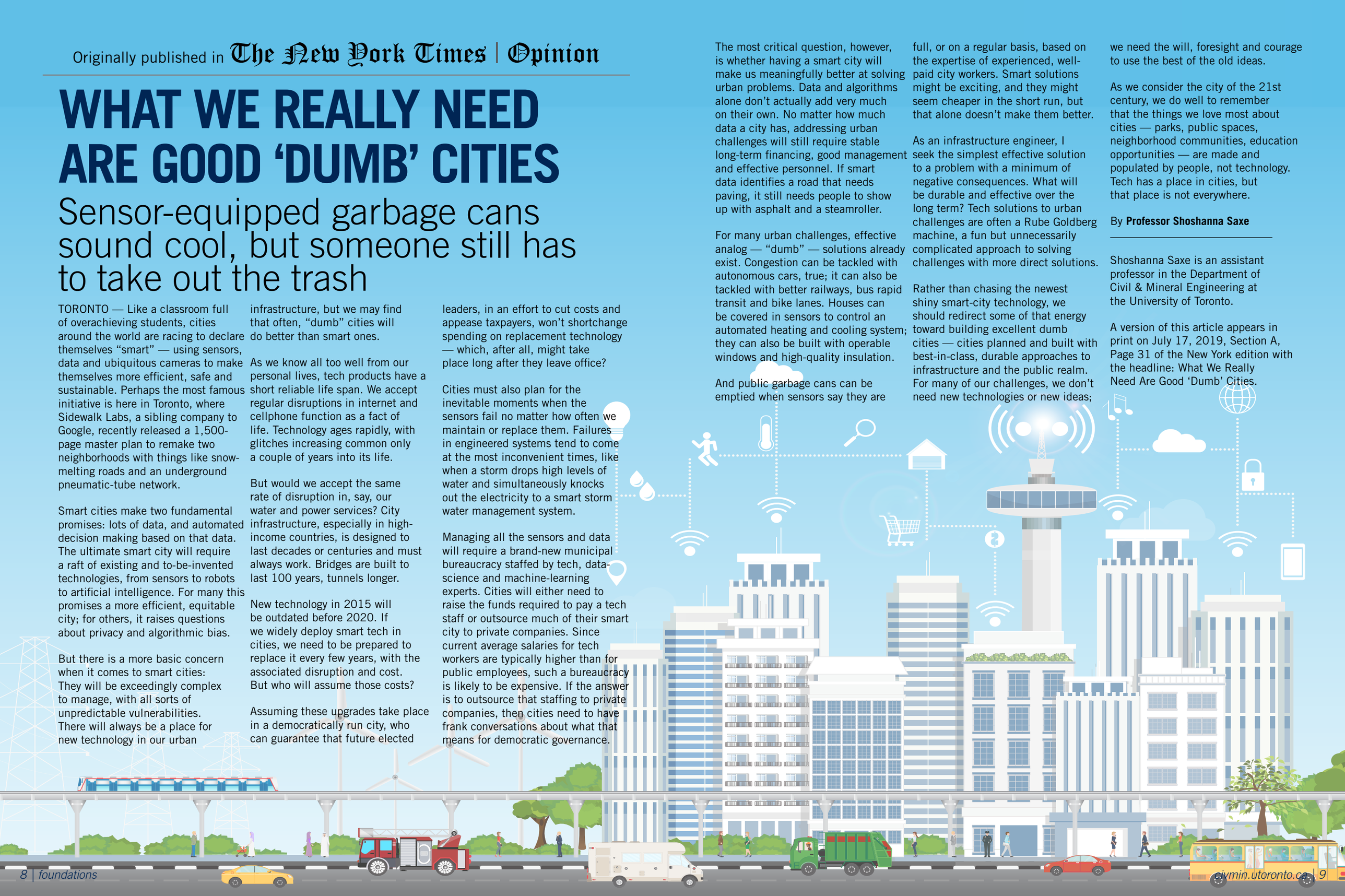
Rather than chasing the newest shiny smart-city technology, we should redirect some of that energy toward building excellent dumb cities — cities planned and built with best-in-class, durable approaches to infrastructure and the public realm. For many of our challenges, we don't need new technologies or new ideas; we need the will, foresight and courage to use the best of the old ideas.

As we consider the city of the 21st century, we do well to remember that the things we love most about cities — parks, public spaces, neighborhood communities, education opportunities — are made and populated by people, not technology. Tech has a place in cities, but that place is not everywhere.

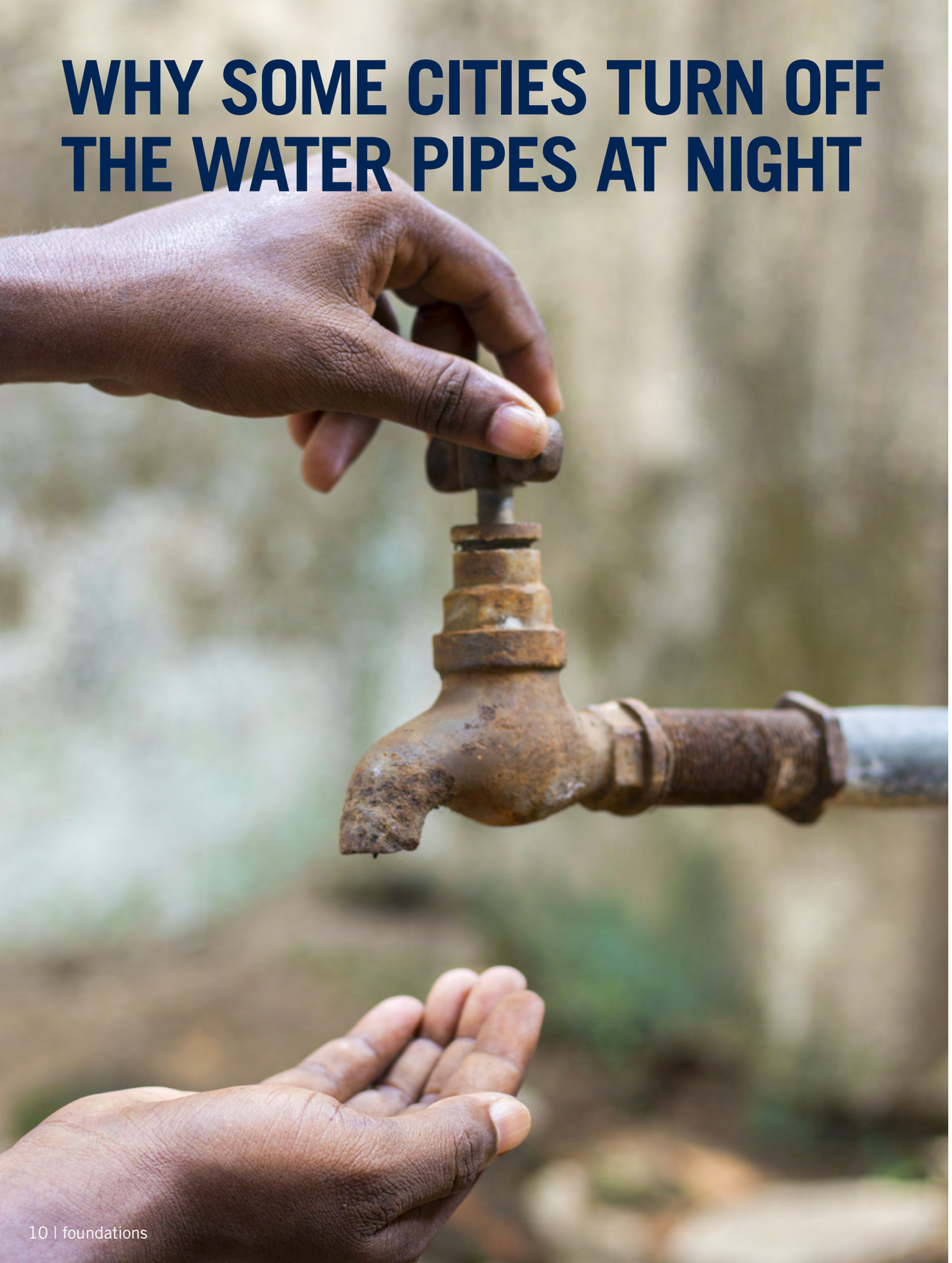
By **Professor Shoshanna Saxe**

Shoshanna Saxe is an assistant professor in the Department of Civil & Mineral Engineering at the University of Toronto.

A version of this article appears in print on July 17, 2019, Section A, Page 31 of the New York edition with the headline: What We Really Need Are Good 'Dumb' Cities.



WHY SOME CITIES TURN OFF THE WATER PIPES AT NIGHT



For more than a billion people around the world, running water comes from "intermittent systems" that turn on and off at various times of the week. A new paper by Professor David Taylor (CivMin, CGEN) proposes a simple, yet powerful model to explain why and how these systems come to be — and how they fit into the global challenge of meeting international targets for human development and safe drinking water.

The idea of an intermittent water system may seem strange to engineers from developed countries. Constantly filling and emptying pipes puts a lot of stress on the system due to fluctuations in pressure. It also opens the door to contamination: rainwater or sewage can leak into empty pipes more easily than full ones.

But Taylor believes there may be benefits to intermittent systems as well as drawbacks. "One obvious example is that a pipe can't leak if there is no water in it," he says. "If you have no budget for repairs, turning off the taps at night when nobody is using them is a very effective way to stop losing water to leaks, at least in the short run."

Taylor's PhD thesis involved working with water companies in Delhi, India and trying to understand how intermittent operations affected their ability to meet customer demand. One way to do this is to build a hydraulic model — a virtual representation of every pipe, valve and customer inside a computer. But Taylor quickly found that such detailed models weren't especially helpful.

"These systems are chaotic," says Taylor. "There are often pipes or valves that are missing from the official charts. We usually don't know as much as we think we do, and in that situation, fancy models can't tell us much."

But rather than give up, Taylor asked himself a question: what would the model look like if I admit that I know almost nothing about the network?

"You don't need a detailed understanding of food chemistry to know that if you want twice as many cookies you had better add twice as much of everything, not just the flour," says Taylor. "It turns out that if you model a water supply system in this simple, first-order way, there's a lot you can learn."

Taylor's single-equation model can, among other things, describe the key differences between how a system behaves when customers are satisfied versus when they are not. When customers are not satisfied, doubling supply time — say moving from one to two hours per day — requires twice the amount of water, because people are taking all they can get.

But when customers are getting enough water, demand levels off. In this situation, each additional hour costs a lot less because weaker effects, such as leakage, are now the dominant factor.

This distinction helps resolve a long-standing debate about whether intermittent systems waste water or save water. In the unsatisfied case, they probably save water, but they do so by leaving customers thirsty. In the satisfied case, the hassle of turning off and on the pipes probably isn't worth the gain in terms of water savings.

In a paper entitled "Demand Satisfaction as a Framework for Understanding Intermittent Water Supply Systems" recently published in Water Resources Research Taylor lays out his model and describes how it might be used to analyze existing systems and set goals for new ones. He calibrated the model by comparing its results with those of a much more complex one, and found that the agreement between the two models was high enough to be able to provide useful insights, such as whether a given upgrade is likely to be cost-effective.

"The model lets you see right away what the effect of altering a parameter is going to be, whether it's leakage or demand or whatever," says Taylor. "That enables you to do these back-of-the-envelope calculations and determine whether what you're proposing is feasible."

Another key aspect of the model is that it is formulated in dimensionless terms. For example, the amount of time the system supplies water is not measured in minutes or hours, but rather the percentage of time the system is turned on. This makes it easier to compare systems with each other.

Residents in cities with intermittent water systems typically store water in their homes. Yet not all residents have the capacity to store a day's worth of water to meet their needs. So, it's critical to understand how the duration of water supplies affect each individual's access to the resource.

Taylor also hopes that this model will help in global efforts to meet the UN's Sustainable Development Goals and its Human Right to Water. "These documents say that water needs to be 'available when needed,' but that might mean different things in different places," he says. "Maybe its 24 hours a day, maybe it's 12, maybe it's less. What I hope this model can do is present a theoretical framework for how we decide which systems count as safely managed water supplies and which ones don't."

"Without a way to decide which intermittent systems count as 'safe', we don't stand a chance of hitting our 2030 global goals for access to clean and affordable water," he adds. "The model can help guide us as we start to make the major infrastructure investments needed to hit these goals."

By **Tyler Irving**, with files from Keenan Dixon

Come hear Prof. David Taylor speak in the Skule™ Lunch & Learn Series on Nov. 13, 2019. More details at: **alumni.engineering.utoronto.ca**

Prof. Khandker Nurul Habib (L) and MASc Candidate Sina Azizi Sodouz. Photo by Phill Snel

ON BEING SEEN

Autonomous vehicles and pedestrians with sight loss

Pedestrians take their chances crossing the street as it is; making eye contact with a driver before crossing at an intersection is a standard practice to ensure one's safety. But what if the pedestrian is visually impaired? What if the vehicle has no driver?

These are some of the questions facing our society as the rush to deploy fully-autonomous vehicles onto the streets intensifies. With the need to develop policies, and laws, around this increasingly complex subject comes the need for more research and understanding. This is precisely where research meets the road.

Sina Azizi Soldouz, a MASc candidate under the supervision of Professor Khandker Nurul Habib, is focusing on the potential impacts of connected autonomous vehicles (CAV) on pedestrians with sight loss. A survey of pedestrians with sight loss was conducted in collaboration with the Canadian National Institute for the Blind (CNIB) under the title "Understanding the impact of connected and automated vehicles for pedestrians with sight loss – a policy framework".

"When Professor Habib told me I was very keen. I didn't know anyone visually impaired," said Soldouz. "It took six months of research with good collaboration." Survey design was accomplished with Dr. Mahadeo Sukhai, Head of Research and Chief Accessibility Officer at CNIB.

Participants were asked about current approaches and issues with using the existing transportation network. Using the present situation as a basis, several hypothetical scenarios were created for the study involving various levels of CAV interaction. The overall vision was to provide recommendations regarding the introduction of CAV technologies.

Overall, there is some degree of mistrust of fully-automated technology. The level of trust does, however, increase over time and direct experience. It is important to note the majority of those with sight loss are not completely without some vision.

Prof. Habib stated, "Along with all technological advances, we need to make sure the transportation system is inclusive and has no blind spot. This research on pedestrians with sight loss in an era of AV showcases our commitment to ensure the elimination of transportation-induced social exclusion in the future."

Concerns for visually impaired

If a great number of autonomous vehicles becomes a reality, then a concern for those with visual impairment is a potential loss of real, or perceived, safety. The lack of a real person to communicate with, as well as not knowing if a vehicle is nearby, can be disconcerting. A fear of exercising mobility could lead to isolation, and loss of social and economic vitality.

How automated?

The level of automation for a vehicle can be scored on a scale of one to five. A level one vehicle is fully controlled by a person, and has no automation involved, while a level five would be considered fully controlled by the technology alone with no human interaction whatsoever. Currently, with existing market features widely available, we are at a level three or four; the vehicle is able to detect the environment and make decisions for itself, but some human override is required or available.

In the artificial intelligence (AI) community the term "algorithmic responsibility" is bandied about in discussions regarding giving the programming values or morals. After all, machines might have to one day make a life-or-death, or even death-or-death, decision in a fraction of a second. There are many ethical dilemmas involved in this area, and will surely be very important moving forward.

The promise of 5G

As the technology for 5G connectivity advances and makes CAVs a reality, so too does the promise of increased usefulness for connected wearable devices to assist the visually impaired. Devices with 5G connectivity, and short-range detection systems, could allow CAVs and people to "see" each other virtually and to make allowances, or provide guidance, for the other(s).

Weather in Canada remains a concern, as winter can create chaotic driving conditions. Soldouz is confident of progress and says, "There's still a long way to go in Canada, but technology has improved prominently and we cannot stop it."

Currently, such products as Blind Square, Victor Trek, Key2Access and Microsoft Soundscapes (coming soon) are designed to help the visually impaired read books, maps and more. As an example, Key2Access can use wireless technology to allow a pedestrian user to request crossing at an intersection without having to find and touch the physical button.

Key recommendations

If everyone involved in creating CAVs, and connected wearable technology, has the same guidelines provided by municipal, provincial and federal governments, then a uniform and cohesive network can be achieved. The experience for those travelling by foot, automobile or bicycle would then be similar in various environments across the country.

With a consistent system of access to local data for connected devices, it would be possible for vulnerable road users to access information like temporary sidewalk closures or construction.

Before mass deployment of wearable devices becomes common, more exhaustive testing of infrastructure and vehicles must be inclusive of persons with diverse abilities. On the plus side, as wearable technology becomes more popular and accepted, the cost-per-unit should decrease and make it more affordable for all.

"I look forward to seeing how technology will progress," said Soldouz.

Sina Azizi Soldouz is a MASc candidate under the supervision of Professor Khandker Nurul Habib. His research focuses on analyzing the impacts of CAV on pedestrians with sight loss. He holds an MSc in Highway Design Engineering from Imam Khomeini Intl University, Iran and a BS from Azad University, Tehran, Iran. He is interested in transportation planning, and in particular travel demand modeling and data analysis.

By **Phill Snel**

What's a connected autonomous vehicle (CAV)?

A connected autonomous vehicle (CAV) is an autonomous vehicle (AV) that is able drive itself independently, but is also able to connect and communicate with other vehicles and devices around it. It is also known by other names, such as driverless vehicle, self-driving car, or even robot car. Regardless, the technology is the same – no human intervention is needed for the vehicle to maneuver streets and highways on its own.

With coming 5G networks connectivity between devices is to be nearly instantaneous, allowing for the CAV to rapidly communicate with nearby vehicles, wearable devices, static objects and other networks including information about weather and driving conditions.

ENGINEERS AND THE ENVIRONMENT:

FINDING THE PATH

Photo by Phill Snel

BARRY HITCHCOCK (CIV5T8)

An Australian who only planned a stopover in Canada at the beginning of his 1954 travels, Barry Hitchcock found himself in love and stayed.

After receiving his degree in Civil Engineering from the University of Toronto, he spent some time back home "down under" to work, then returned to Toronto. It meant a lot of slow travel by sea in the era before travel by jet was common. The pace of long distance travel might have been slow at first, but Hitchcock soon found himself in the fast lane of civil engineering and coming to terms with environmental concerns.

"Highway Fight Tonight" trumpeted the newspaper headline. Hitchcock stopped in his tracks. Seeing the words in print while on his way to a routine Hamilton, Ont. city council meeting, he immediately knew the usually easy approval process had drastically changed for major construction projects.

It was about 1967. Hitchcock had arrived on behalf of the Ministry of Transportation Ontario (MTO) to present a plan for a Dundas, Ont. highway bypass across a valley for approval. This usual mere formality met unusual local resistance for the first time in his experience.

In this case, the MTO backed away. "I think that might have been one of the tipping points of the Environmental Assessment Act (enacted in 1975), which happened regarding highways," recounted Hitchcock.

Hitchcock now believes only legislation will work to make builders more responsible towards their environmental impact. "Engineers are not going to do this on their own. It has to be enacted in some kind of regulation, or law, that they have to do it." Hitchcock added, "So that the client understands then that they've got to pay for that. They're not going to pay an engineer extra money unless they see a benefit."

Previous to the Hamilton council meeting, big civil engineering projects had usually been met with enthusiasm in the communities involved. A new highway, railway, bridge or other big project meant prosperity to the area in the form of ease of shipping, local jobs, or modern conveniences more easily accessible. There never seemed to be a downside.

The Dundas bypass was the first time a major project failed to thrill the community. From then on, major civil engineering projects had to consider more than just optimal methods for construction, but had to more cautiously include local concerns and the local wildlife and environment.

Hitchcock's past experience with major projects having environmental impact would prove significant in the course of his career.

"I wanted to be in some career, or profession, where I could work with the resources of the planet for the benefit of mankind."

Engineering start

Hitchcock's first association with engineering was with the Water Conservation and Irrigation Commission of New South Wales (Australia). "I wanted to be in some career, or profession, where I could work with the resources of the planet for the benefit of mankind. That seemed to be well in line with that kind of ambition," said Hitchcock.

"I graduated from high school in 1947 and at that time the universities were crammed with returned service men and there wasn't much opportunity for we school kids to get into university. So the New South Wales government had a program they called Cadet Engineers, so they would hire kids fresh out of high school and commit to pay for their education and put them through a training program working in one of the government ministries.

It was a six year program where I moved around different departments from the design of irrigation works, design of dams, doing hydrographic surveys, and land and construction surveys. I got experience in all of those fields over the six year period while I attended the Sydney Technical College (later University of New South Wales) at night, with some day courses they gave time off to complete. That got me a diploma in civil engineering."

Unexpected environmental impact: The Snowy Mountains Scheme

When asked about how engineers used to think about the environment, Hitchcock replied bluntly, "I don't think engineers thought very much about the environment then. I don't know whether the word 'environment' was a word that was used in those days."

"Looking back there was an environmental impact from the work that I was doing in irrigation. Irrigating parched lands in western New South Wales. What the agriculturists didn't understand was below the surface there was a layer of salt, so when they irrigated it, the salt came to the surface and poisoned the ground. That was my first experience with an environmental impact; it was a bad impact that wasn't foreseen."

"I was in a way involved with the Snowy Mountains Scheme," recalled Hitchcock, "which was the biggest engineering project worldwide at the time. I was doing hydrographic river flow measurements in the high country. The Snowy River flowed out of the mountains into the Tasman Sea – a short distance. So the wisdom was we were wasting all that water running into the ocean. We should be diverting it west to use the water for irrigation and open up vast tracts of land, and also generate electricity."

"The Snowy Mountain Scheme was a system of dams and tunnels to divert the water that was flowing east into the western rivers so that there was an abundance of water flowing west and used for opening up new areas for irrigation.

"The worst thing that happened was that the Snowy River, being deprived of a lot of its water, deteriorated not only the river, but the land and the people who depended on the water. That was an environmental impact that was not recognized when they built the Scheme. Since then they've tried to remedy that by periodically flushing water down the Snowy.

"There's two examples of environmental impact that were not foreseen by engineers," he concluded.

Finding new homes around the world

Hitchcock's family is no stranger to long distance travel coinciding with history. In fact, he can trace his family's lineage in Australia to some of the original prisoners exiled to the penal colony then known as "New Holland".

"Myself, I go back to the founding of the colony in Sydney (Australia). My great-great-grandfather was a convict who was transported there in the first fleet that founded the colony (in 1788). He had been convicted in the Old Bailey for stealing some cloth in South London. The sentence was transportation to Australia," said Hitchcock.

"My great-great-grandmother came on the second fleet in 1790 and was the first ship of that fleet, called the Lady Juliana, with women convicts. She was a 15-year-old when she was convicted of stealing from her mistress some lace and cutlery," recounted Hitchcock, before adding, "They got married in 1790, soon after her arrival in the colony, and they both got their ticket of leave and a grant of land that they successfully farmed Their descendants in my line achieved prominence in the business, science and theatre arts."

In 1954 any travel from Australia required an enormous time commitment. Hitchcock settled on a plan to embark on a five-year trip, with his first stop slated to be in Canada.

Three weeks by sea to reach Vancouver, followed by a week-long train trip to Toronto, saw him arrive the very day Hurricane Hazel struck the city. The October 15, 1954 storm saw devastation wrought by nature's wrath unlike any in local memory.

"There was a whole community washed out in the hurricane in Etobicoke (now part of Toronto). That was in the Humber River. The housing community in the Humber River flood plain. And they just got washed down the river into Lake Ontario and many people died. That was the day I arrived in Toronto," reflected Hitchcock.

He had not planned on staying in Canada, with a view to still cross the Atlantic for his expected trip to England, but fate intervened. Betty, his love interest, became his bride.

U of T connection

"I applied for a license with Professional Engineers Ontario at that time, and they didn't give it to me," said Hitchcock. "I couldn't see the point in getting a license by passing the exams they set, which probably wouldn't count outside Ontario."

"So (in 1956) I came and talked with Professor (Carson) Morrison at the University of Toronto about getting admitted to the University here. They admitted me in the third year, and so I did the third and fourth years to graduate in 1958."

To put his graduation year in perspective, it was two years before the present-day Galbraith Building was opened in 1960.

Asked if he attended Survey Camp, Hitchcock quipped, "No. I had worked as a surveyor and they thought I was so good at it that I could have probably taught the subject. So I didn't go to the Survey Camp, but I did go to the reunions. My classmates would talk about Survey Camp. It was the main topic of conversation whenever we would have a reunion, so I thought I should go when they had a reunion there to see what they were talking about."

Canadian career

After two years back in Australia, working as resident engineer constructing a supertanker berth in Sydney Harbour, Hitchcock returned to Canada in 1962. This time it was only a two-week journey by ship, representing technological improvements in travel.

While working for Giffels Associates Limited, Consulting Engineers & Architects for several years, then American-owned, the chance came to buy into the company to form a fully Canadian-owned arm, so Hitchcock joined the plan. It would turn into a 31-year career.

"We grew the company into one of eminence in Ontario in the field of transportation and municipal infrastructure."

"We addressed the environmental issues in the 1970s and that might have been the beginning of when the MTO started doing environmental impact studies with all of their planning. And then it became the Environmental Assessment Act which was a requirement to do before any public works projects proceeded. Not just highways, but any public works."

By 1991 Hitchcock became president of the Professional Engineers Ontario, and was afterwards appointed to the board of Engineers Canada in Ottawa.

In 1994, after chairing a national task force to develop guidelines for engineers with respect to the environment, Hitchcock produced a report. According to him, "when they developed these guidelines they sent them out to the provinces for ratification, but I surmise that since some of the guidelines would require government legislation for engineers to comply, it was never ratified. As far as I know, that report is sitting on a shelf in Ottawa never been used."

"Engineers should be responsible for the environmental impact; not just for the design and construction and use of the product, but also its life cycle. It's eventual decommissioning, and so on. The entire life."

Responsibility of engineers

Hitchcock is unabashedly passionate about his gestalt views regarding the place of engineers in the world. "Engineers should be responsible for the environmental impact; not just for the design and construction and use of the product, but also its life cycle. It's eventual decommissioning, and so on. The entire life."

"And this should apply to all engineering in all fields, not just civil engineering. Anything, everything that's engineered. They should be looking at the lifecycle of a product to ensure that it's environmentally responsible."

Barry Hitchcock, 90, and wife Betty, reside in the Toronto suburb of Scarborough. Hitchcock keeps abreast of engineering trends and issues through his memberships in Professional Engineers Ontario, Engineers Australia and as a Fellow of the Canadian Society for Civil Engineering, subscription to U of T's CivMin Alumni magazine (** !!XXX PROPER NEW NAME?), Alumni events, and the Distinguished Lecture Series talks.

Barry and Betty strongly believe in giving back to society through volunteering. Barry has done this through his professions, Kiwanis, community, sporting organizations and on the board of the Scarborough General Hospital.

By **Phill Snel**

Photo by Phill Snel

TAKE A LOOK INSIDE THE NEW BUNKHOUSE AND COMMON ROOM

Rendering provided by V+A Architects.

Survey Camp at Gull Lake is celebrating its centennial and getting a new bunkhouse. Nearly a century after the first group of University of Toronto Engineering students used the site, located on the north shore of Gull Lake near Minden, Ont., a modern and flexible-use building has been planned.

Purchased in 1919, the first cohort of U of T students took classes on the site in 1920, with the current 2019 class becoming the 100th consecutive year to attend Survey Camp – now known as Civil And Mineral Practicals (CAMP).

Centennial celebrations included the ceremonial launch for construction of two new connected buildings, a bunkhouse and common room, on Saturday, September 7, 2019.

A distinction between the site and the course might seem superfluous, but has become the recognized norm with "Camp" being the location and "CAMP" denoting the proper name for the course of study.

Expanding numbers in a single season

Over the century, the number of attendees to the site has continued to grow, and it's not just engineering undergrads who attend Camp for CAMP. High school students, attending the Da Vinci Engineering Enrichment Program (DEEP) Leadership Camp since 2003, have required the creative reconfiguration of the bunkhouse layout and the overall site for their different age-specific use requirements during their stay.

With uninsulated accommodations, the short summer season has led to a fairly crowded scheduling of the DEEP Leadership Camp, two separate two-week CAMP courses in August (formerly known as Survey Camp), followed by two groups that each stay for an overnight in September for the second year Introduction to Civil Engineering course.

As the number of students visiting annually has increased, so too has the representation of women in Civil and Mineral Engineering, coming in at just over 47 per cent of the current class. The current bunkhouse is one big room, designed for what used to be an all-male class of attendees. As a solution, the old Stewart Hall building layout was reconfigured to allow for separate sleeping and washroom space for women, but this arrangement is no longer meeting our needs.

Planning and parameters

Planning for a new building requires a dedicated approach, many opinions sought, several committees to meet with and hoops to jump through. "What we want is for it not to stick out (compared to the other buildings); it's about the place, not about the building," said Professor Brenda McCabe, who is acting as the faculty lead on the project.

Among the considerations, with feedback from students and alumni, was the new building should create continuity with existing structures, recognize the character and culture of survey camp, and maintain the existing site topography. Other considerations include the need for accessibility under the Accessibility Ontarians with Disabilities Act (AODA), giving wheelchair access to bedrooms, washrooms, and the common room.

The new project aims to extend the window for the site to be usable by the University. "We wanted three-season, and well-insulated," said McCabe. "But still with a passive design since we want it to be as energy neutral as possible, so the design needs to be well thought through. It has to be easy to maintain."

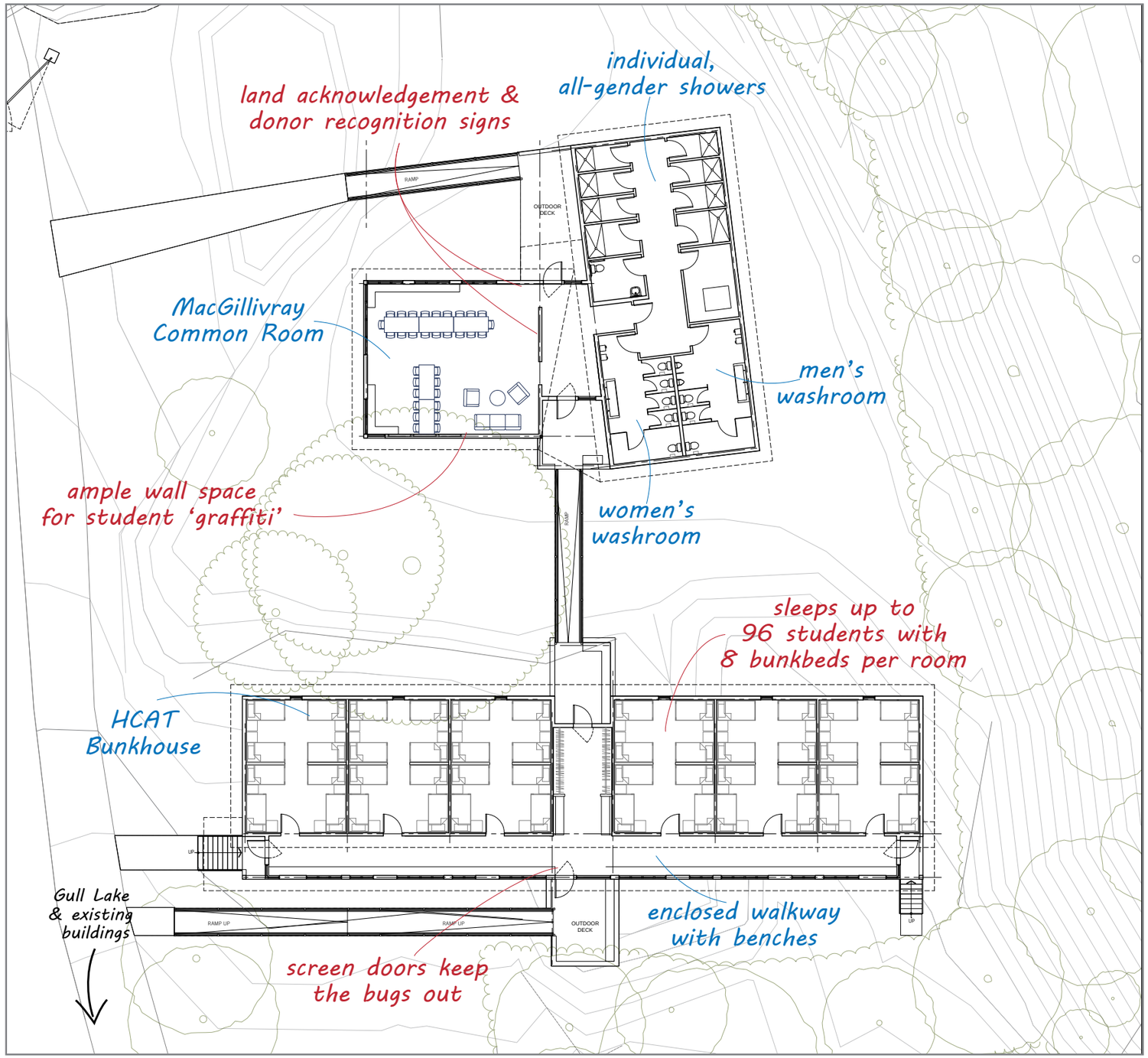
"From the alumni [perspective] it's primarily to make sure it's a sustainable building. Which means probably PV (photovoltaic)," said McCabe. "While we don't have a budget to install a PV system right away, we have planned for it and there is a location on the roof where PV panels can be installed."

As for the exterior cladding, "It's a cement board, so it's very functional, low maintenance and economical." Suggestions for the outside colour have ranged from a similar green of the old bunkhouse, to a bright yellow, but a more neutral and soothing tone is being considered at the moment.

Overview

Gently sloping and staggered roof lines allow for high ceilings with windows for light and ventilation, especially helpful in the summer heat. The shape also emulates the gentle slopes of the immediate land contouring, enabling the new buildings to nestle into the existing landscape.

When asked about the design including two separate buildings, one for sleeping accommodations, and the other for a common room and washroom facilities, McCabe stated, "It was unexpected. The architect came up with it. That was their role; they certainly did things that we would not have dreamed of."



Floorplan provided by V+A Architects.

"It was two separate buildings," according to McCabe. "I think that was interesting for us because then we only have one "wet building" – with plumbing and running water. It makes it simpler for maintenance and cleaning – it's all in one area, as opposed to being separate or spread out."

The new facilities include two separate single-storey buildings connected by a gently sloped and covered walkway. The sleeping accommodations (to be known as the HCAT Bunkhouse, in appreciation of the generous support provided by the Heavy Construction Association of Toronto) will be positioned to the south and include several separated rooms along a long corridor, running east-west with south-facing windows, towards the lake. Benches will run the length of the corridor by the windows and allow for indoor socializing space. Stairs leading south, down from the sleeping accommodations, to an outside deck allow for splendid views and a social gathering space.

> Each bedroom, bench and bunkbed offers a sponsorship opportunity for alumni and supporters to carry on the long tradition of giving back to Camp through contributions, volunteerism and monuments.

Bunkhouse

The new bunkhouse will not be the usual open-plan long bunkhouse of the past. It will have six individual rooms with up to eight bunkbeds each, allowing a maximum of 16 campers per room, for a maximum total potential capacity of 96 occupants.

The rooms are designed for maximum flexibility in configuration, and can be adjusted for multiple needs and uses. There is a need for flexible sleeping spaces particularly to accommodate our changing demographic of students – for example the Department had a female student population of less than five per cent in 1960, versus a nearly 50 per cent female student population today.

Students enter the HCAT Bunkhouse (named after Heavy Construction Association of Toronto) to find a large vestibule area, including two closets where coats and wet gear can be stowed (especially after long, rainy days on the highway curve), leading to the walkway headed north.

The entry with added storage was planned. "We asked specifically for this space for coats. When we've got especially wet weather, we need places for stuff to dry out. If it goes into the bunkhouses, it's lying all over. There isn't really a place to hang things up. So we asked for a place where they can put their wet things – there will be a breeze coming through, there will be a nice area there for stuff to dry out."

Lounge

In the north building, a generously-sized common room (to be called the MacGillivray Common Room in appreciation of Robert and Scott MacGillivray's generous support) is designed for socializing, relaxing and informal gathering – along with the obligatory late nights to finish the day's assignments. In addition to ample wall-space for student "graffiti", there will be signage to recognize all those who attended CAMP at Dorset (Ont.).

Across the hall from the common room one finds the washroom facilities comprised of eight individual shower rooms, a single fully-accessible washroom with shower, and men's and women's separate large common washrooms, each with an accessible stall.

Did you know?

To accommodate a growing student population after World War II, the Department ran two concurrent Survey Camps, one at Gull Lake's U of T Survey Camp and the other at the Ontario Forest Ranger School near Dorset, Ontario.

The Dorset site was considered less 'rustic' and more comfortable than the Gull Lake facility, and for many years was where all female students attended CAMP – since it had the facilities to accommodate women alongside men.

However, due to increasing costs to use the Dorset site, the Department began to offer CAMP exclusively at the Gull Lake site in the '90s.

Flexibility

"Depending on which group is using the facility, the needs are going to change. Younger groups may use it and would they need, for example, an instructor in each of the rooms where students are sleeping? Those things are so different from our needs, that I'm not certain how that's going to work for them, but the existing buildings work for them. I think that's an important component. And they completely transform the way that the buildings are used when they're there – the staff house becomes a medical centre, for example."

Creature comforts

Asked if there might be laundry facilities or refrigerators for snacks, the response was candid. "No laundry facilities in Camp. It's a good reason for the students to go to town. It also requires more septic." As for refrigeration, "No – there's no beer fridge," conceded McCabe. "We don't want food or snacks in the sleeping facilities because of the chances of having critters come sniffing for a snack. But surprisingly, we don't get that kind of complaint from the students. They're too busy." Otherwise, "It means they're not working hard enough."

What will happen with the old bunkhouse?

"One of the things we want to do, once we have the new bunkhouse working, is explore the idea of turning it into a group assembly space, so that we can have lectures, or large group meetings in there. The classrooms are too small to hold the whole group at once."

Rendering provided by V+A Architects.

A land acknowledgement, created by a local artist, Solomon King of Stone Artisan Studios Ltd., is to be displayed inside the common room:

"We respectfully acknowledge that University of Toronto's Gull Lake Camp is located on the Treaty 20 Michi Saagiig territory and in the traditional territory of the Michi Saagiig and Chippewa Nations, collectively known as the Williams Treaties First Nations, which include: Curve Lake, Hiawatha, Alderville, Scugog Island, Rama, Beausoleil, and Georgina Island First Nations.

University of Toronto respectfully acknowledges that the Williams Treaties First Nations are the stewards and caretakers of these lands and waters in perpetuity, and that they continue to maintain this responsibility to ensure their health and integrity for generations to come."

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

Kirk M. Allan, 8T2
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Anonymous (multiple)
Michael Aresta, 1T7
The Association of Ontario Land Surveyors (AOLS)
John Bajc, 8T2
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Wayne M. Bennett, 6T9
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Devon G. and Linda J. Biddle, 6T7
John A Bond, 6T8
Dawn Britton
Kenneth R. Brown, 6T9
David C. Brownlow, 5T6
Buttcon Limited
W. Brian Carter, 6T1
John Challis, 5T1
Arun Channan, 8T0
So M. Chiang, 0T0
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Classes of Civil 6T0–6T5 Campaign for CAMP
Class of Civil 6T8 for CAMP
Class of Civil 8T0 Campaign for CAMP
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Yifan Geng, 1T5
Wayne S Gibson, 8T3
Arousha Gilanpour, 9T5
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Gordon Gracie, 5T2
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Donald H. Grandy, 8T4
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Walter J. Hendry, 6T0
Alvin Ho, 9T8
Vera Y Kan, 0T0
William P Kauppinen, 6T8
Leslie & Margaret Kende 6T0
Allan M. Koivu, 8T6
Tetsuo G Kumagai, 6T8
Ross Lawrence, 5T6
Arthur Leitch, 6T9
Yiu Chung Li, 6T3
Michael Loudon, 6T6
Robert MacGillivray, 8T5
Scott MacGillivray, 8T2
G. Alexander Macklin, 5T5
Mateen Mahboubi, 0T7
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Orlando Martini, 5T6
Levana Mattacchione, 1T3
Brenda McCabe, 9T4
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Malcolm McGrath, 5T4
Robert McQuillan, 5T0
Joel Miller, 6T5
Model Railings & Ironworks Inc.
Ricky Junji Mori, 6T8
Loui Pappas, 8T8
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Robert Piggott, 5T7
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Glenn L. Rogers
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Arthur H. Watson, 7T5
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Gabriel Wolofsky, 1T7
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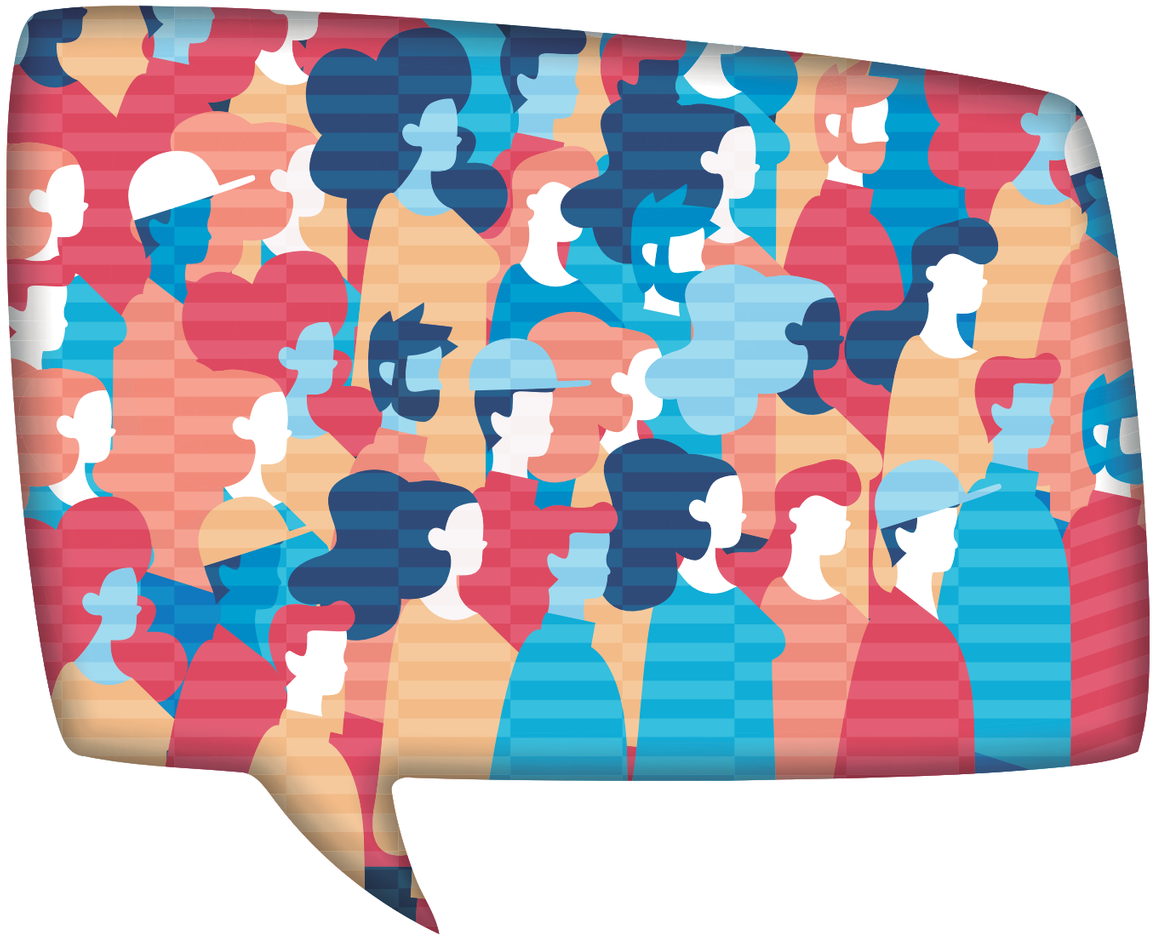
Victor N. Zubacs, 6T9

Centennial Campaign for CAMP Donors as of August 22, 2019.

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.

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



EQUITY ACCESSIBILITY DIVERSITY INCLUSION

WHAT ROLE DO ENGINEERS PLAY:

FACULTY PERSPECTIVES

We asked some faculty members to weigh in on how engineers and academics help to make the world a more equitable, diverse, inclusive and accessible place

DIVERSITY AND EQUITY IN THE DOMAIN OF CIVIL ENGINEERING

Bryan Karney

The world in which civil engineers practice their trade is characterized by an almost overwhelming diversity and variety. Indeed, it has been said with considerable accuracy that no two hydroelectric projects are ever really the same. Such a statement of variation is surely also valid about most infrastructure projects and about every city within which civil engineers design buildings, conceive transportation networks and build water handling systems.

Thus, why would we as civil engineers expect things to be any different when considering the people for whom the acts and achievements of engineering are directed and intended to benefit? People too are remarkably diverse, characterized by an almost unfathomable variation of characteristics, skills, interests, tendencies and backgrounds. As successful engineering demands that the engineer attend, account for, and in some sense celebrate the variations of the natural system, and of the materials we employ, so too we should strive within our professional practice to account for – to deeply and profoundly embed – our understanding of the human dimension into our professional designs and actions.

Aldo Leopold was an articulate writer, thoughtful educator, influential conservationist and an outdoor enthusiast. One of his best known ideas – his so-called "land ethic" – calls for a synergistic and caring relationship between people and nature. In Leopold's Sand County Almanac he makes a profound and often quoted statement: "To save every cog and wheel is the first precaution of the intelligent tinkerer." This is certainly true of watches and machines – and makes the point profoundly for each species within the ecological systems that Leopold had in mind. But this principle is surely true also for the other domain in which engineers work – that in human society we should keep as many voices and perspectives as we can at the table where they can be attended to and thoughtfully considered.

But there is perhaps another aspect of the engineering background that is essential to bear in mind. Enzo Levi, in his painstaking history of our human understanding of water science, said of the hydraulician that they must entice water "to agree to our will, respecting its own at the same time". That is, that water engineering – and indeed all engineering – must ultimately be a kind of "negotiation" between human desires and wishes and nature's response. No human decree, no amount of wishful thinking, will stop water from being water nor steel or concrete from having real limits on their elasticity and strength. Indeed, I firmly believe that one of the greatest merits of an engineering education is the instilled and deep knowledge that the physical world truly exists and exercises hard constraints on human aspirations and designs. We don't just create and elaborate our designs after a conversation with a client, or even as a creative act arising from human aspirations alone, but from an active consideration of what the laws and properties of what matter and energy make possible.

But if we do our jobs well – with diligence, and care, and with an understanding of the human and natural worlds – we perhaps have more capacity and responsibility than many to change the world. As we can mar it by our worse acts, supressing its characteristics and its diversity, so too we are capable of enriching the world and improving the lives and experience of many people. May we be the kind of engineers whose actions and design both protect and enhance the world we precariously inhabit even as we seek to improve the lives and experiences of that remarkable variety of people we seek to serve.

FRUGALIZATION OF ADVANCED TECHNOLOGIES

Equal access to safe, affordable and resilient housing around the world is possible

Constantin Christopoulos

Many natural disasters happen in developing countries whose populations can include the world's poorest people. These people live in slums and improvised housing, and are further marginalized when a disaster like an earthquake happens. In addition to the loss of life, these people usually lose all of their property and ability to access a livelihood, and are affected to the point where they may not recover for decades after such a devastating event.

Our research group is working with the Centre for Global Engineering (CGEN) to examine shelter for the most disadvantaged populations around the globe. We ask ourselves, "If we have all of this sophisticated engineering knowledge and capabilities, is it possible to solve some of the problems in developing areas and provide workable solutions that are going to actually have an impact on the lives of millions of people?"

One significant barrier to building resilient housing in the developing world is cost. High-end, sophisticated systems, which require skilled technicians and engineers, to design, build and install, are not viable solutions for the millions of people who live in the poorest conditions. So we need to look to the idea of "frugalizing" technologies if we really want to impact the lives of these people.

The concept of frugalization is to look at the fundamentals of a really good idea, which has been developed as a high-end solution, go back and say, "Okay, if I had to redevelop this and take advantage of the physics behind this idea, but implement it in a way that it can be done at extremely low cost, and in a construction environment whose engineering, inspection and quality control practices are not as sophisticated as our own, how would I go about reinventing this technology?"

So, one of these technologies we're focusing on, for earthquake-resilient mass-housing projects, is seismic isolation. Isolation consists of adding a very flexible layer between the structure and the ground such that the effects of ground shaking is not transferred to the structure, thus protecting it.

Our solution is actually a very simple one. Instead of highly-engineered seismic isolation bearings that grace the column-bases of bridges, buildings and other resilient, critical infrastructure, we are investigating the use of a thin, flat, polymer pad, with very low friction – think along the lines of Teflon – installed at the base of each structural post. The pad, a few millimeters thick and about the area of a square foot, isolates the structural elements of the building when the ground is shaking, rendering the building, not only safe to re-enter, but also safe to re-occupy and use immediately after an earthquake.

While we are still testing different materials, the cost is only as high as C$10 per pad, or roughly C$2,000 for a typical 10-20-storey apartment building. The simple solution is also prescriptive, requiring installers to have minimal training and expertise in the technology. It would only be one additional step, or layer, added to the building process, which we hope will be easy to adopt by local contractors.

Our goal is not to disrupt the entire local construction industry or to impose a solution, which will not work with existing practices and building designs. So what we've done is work with IC-Impacts (the India-Canada Centre for Innovative Multidisciplinary Partnerships to Accelerate Community Transformation and Sustainability) to develop a seismic solution that integrates seamlessly with the construction industry in India. To this end, we had visitors from India help us define buildings as they are constructed in India, so we know our solution would work with standard buildings there. Doctoral candidate Farbod Pakpour is completing his PhD on this challenging project and has travelled multiple times to India to investigate local construction practices and interact with researchers at the Bombay Institute of Technology, one of India's leading engineering schools.

For now, India is an ideal partner country to develop this technology because the government is building vast numbers of subsidized housing to accommodate the millions of people who live in slums, and hundreds of millions more who are expected to move to the cities in the coming decades. While India is the focus right now, the technology we are developing has the potential for widespread use, whether in other developing countries or even in Canada where seismic isolation has only been applied in a handful of structures.

Ultimately, whether abroad or at home, everyone has the right to housing. We, as engineers with the necessary ability, knowledge and skills, can develop and implement technologies that will ensure the safety and security of millions of people.

WE HOLD THE EVIDENCE

Marianne Hatzopoulou

"We hold the evidence," says Associate Professor Marianne Hatzopoulou. "I think one of the roles civil and mineral engineers have in this world is to inform policy decisions. As professors, or researchers, we have a duty to play a role in decision making about how cities evolve, how infrastructure decisions are made, what we build in our cities, what gets priority and what should be funded."

Hatzopoulou believes the role of engineers has evolved to a more all-encompassing and responsible one beyond the already complex task of building something durable and structurally sound.

"The face of civil and mineral engineering is changing a lot.

The new reality holds more than engineering skills. "What they don't realize is there's also a lot of politics that come into play. How do you make your voice heard? Clearly, equity and diversity are not the only driving decisions in this world – people are not winning political campaigns only on equity and diversity. But how do make sure these things have a voice around the table?"

"Now you look at our Department, as an example of that, some of us are looking at the health impacts of environmental damage. We're looking at new technologies in transportation, new intelligence, and new ways of optimizing traffic. The questions that the world is asking have become so complex that single dimension approaches to solve these problems are no longer possible. So civil engineering inherently has to become more diverse in terms of the things we look at. "

"There are different ways in which we define accessibility. In transportation, accessibility represents the opportunities and jobs as well as services, like health care and leisure, that people can access. The kinds of opportunities people can access based on where they live in a city, defines the city and it is certainly one of the primary responsibilities of an engineer to design urban environments that promote accessibility."

"We are able to provide evidence to support these decisions. We have tools, we have models, we have data, we have insights that truly can shape what kind of policy directions our government should be taking, what kind of regulations we should be enforcing, and which ones are going to help steer us, towards more sustainable, equitable, accessible, and diverse cities and societies."

Engineers have more than an opinion, since it is backed up by research. "Everyone else can have a voice, but our voice is also supported by tools and numbers that are credible, and which reflect research that we have been doing for years," she says. "And making sure our evidence is there."

INCLUSIVENESS: HOPE SPRINGS ETERNAL

Kim Pressnail

The 50th Anniversary of an amazing engineering achievement, Apollo 11, recently brought to mind a side bar story of J. Morgan. A Life magazine photo recorded the Cape Canaveral control room on launch day. It included Morgan, an instrumentation controller sitting at a console. In addition to the astronauts making history that day, JoAnn Morgan made history too. Wearing a "navy dress amid a sea of white shirts and skinny ties", she was the only woman in the Control Room.

I was recently reminded by Marta Escedi, that our graduating class of 7T6 had 99 students – but only four were woman. Thankfully, we have come a long way since then. In the graduating class of CIV1T9 over 35 per cent of the graduates were woman. These changes have occurred as people's attitudes have changed. These changes in attitude have been helped along by people like Dean Emerita Cristina who sought to actively encourage woman in engineering. During her tenure from 2006 to 2019, the number of women faculty members almost tripled and the percentage of women in First Year Engineering rose to an all-time high of 40 per cent. Thanks to her determination, and the determination of many others, woman are continuing to break barriers that should never have been there, and their numbers are growing. Although there still is a lot more work to be done, there is hope for true inclusiveness.

With the rise of women in engineering, societal and ultimately family attitudes are changing. Behind each engineering student, whether male or female, you will very often find a very supportive family dedicated to seeing that the next generation succeed. There may have been a time when a women were discouraged from entering engineering. However, as more and more women rise to positions of prominence and influence in the profession, long-standing attitudes are changing.

I was recently challenged by a young engineer who told me the board of directors that I had been on was "an old boys club"! Really? In the face of such a prejudicial allegation, I didn't know how to reply so I remained silent. After all I was 'an old man' and when I served on the board, there was only one woman. So I must be guilty?

I did a little soul searching and I began questioning my own attitudes. I had never kept score before, but I decided to count the number of woman who had worked with me doing graduate work. I had worked with them not because they were women, but because they were bright, hard-working and I thought that I could help them with their studies. Well, the total came to 11. All are very successful in their career pursuits and all, including two professors, are in positions where they can inspire others to follow in their footsteps. So, yes, we have a lot of work to do, but people's attitudes are changing. When I consider these women emissaries, hope springs.

THE TRIPLE BOTTOM LINE

Amer Shalaby

"We evaluate any civil engineering project on the triple bottom line, if you will," says Professor Amer Shalaby in answering what has changed for engineers. "Now we see engineering actions have implications on the environment, on the economy and also on social fabric… and social equities."

Whereas it was previously enough to build a structure to function properly, and to last, it now falls to engineers to consider much more in terms of cost, greenhouse gas (GHG) emissions, sustainability, etc. Now, added to that list, is inclusiveness, diversity and accessibility.

Shalaby, who specializes in transportation, expands on the TBL (or 3BL), "Transportation, for example, is responsible for one-quarter to one-third of the greenhouse gas emissions. So we need to make sure, environmentally speaking, when we plan our transportation network, we evaluate the impact on reduction of greenhouse gas emissions. This is just one example pertaining to the environment. To the economy, obviously, transportation as well really plays a big role on the economy."

"The third one, as I said, the social equity impacts have been traditionally either qualitatively assessed or once they are assessed qualitatively, they've been sort of superficial or not really catching all the impacts. And we play a big role really, as civil engineers. We need to be able to capture those impacts, and try to minimize them."

While a great deal of effort goes into planning for the bulk of public transit commuters at rush hour, it is often the most vulnerable who suffer the most when the main service falters. In Toronto, for example, a downtown subway line may experience a disruption to service that is compensated for with buses brought in from more remote routes. This, in effect, removes service from the lesser-served outlying areas resulting in the greater number of "richer" rush hour commuters receiving service at the expense of the disadvantaged regions.

As a concept for considering different socioeconomic needs, Shalaby elaborates, "In the field of transportation, the focus of social equity impacts is just to ensure people have equitable access to jobs, job opportunities across [large regions], but there wasn't really any focus on what quality of service people are being provided. So people who live in richer neighborhoods might have higher quality access. So it's not just the access, but really the quality of that access. Are buses coming on time, or not? Are they crowded, or not, for those disadvantaged communities, and so on. It's also really trying to go beyond that, to look at what role do new technologies like shared mobility, Uber and Lyft, and so on, play. And also the future of automated technologies, what role can they play in order to fill the gaps and the social equity?"

"So with transportation projects most of the assessments in the past have been qualitative. And when they were quantitative they were a little bit sort of superficial. What we're trying to do now, when we're looking at those issues, is try to develop newer quantitative methods to enable transportation planners and transportation authorities to evaluate social equity impacts of transportation investments in a more quantitative manner, and also to really capture other aspects of the service, not just, you know, travel time."

"So it's not that it wasn't done in the past, but it was done probably in a little bit more superficial manner," says Shalaby.

FROM BETWEEN A ROCK AND A HARD PLACE (FOR WOMEN) TO AN EQUITABLE AND MORE PROFITABLE PLACE FOR ALL

by **Lesley Warren,**
Director of the Lassonde Institute of Mining

Why gender diversity in mining is vital to the strength and future of the industry

Mining's "not so secret" secret

It is an accepted industry-wide truth: mining has a gender diversity issue.

The industry lags behind most other sectors in tackling this systemic problem with recent statistics showing women represent only 16 per cent of the Canadian mining workforce compared to 48 per cent of the overall Canadian workforce.

The challenge of building a gender-balanced workforce stretches from site to the boardroom. According to a 2016 PWC study, the mining industry has the lowest representation of women on boards of any other sector, including oil and gas, technology, and manufacturing. Additionally, out of the top 500 globally listed mining companies, only 8 per cent of executive officers in company leadership roles are women (Mining.com).

Whiffs of change

Between 2018 and 2019, mining companies such as Agnico Eagle, Barrick Gold and Newmont Goldcorp have started making strides in narrowing the gender gap. For example, in 2018, Agnico Eagle became an active participant in The International Women in Resources Mentorship Program (IWRMP), a collaboration between International Women in Mining, Women in Mining Canada and Metisphere. IWRMP connects senior global female mining leaders with mentees in a variety of occupations across the entire mining cycle. In early 2019 Barrick Gold began a certification process for gender equality at its Pueblo Viejo mine in the Dominican Republic. Newmont Goldcorp's CEO, Gary Goldberg, pledged support for Paradigm for Parity, a global corporate initiative to achieve gender parity by 2030 and holding true to that commitment, Newmont most recently appointed three female executives after their merger with Goldcorp. These are all important steps, however for systemic transformative change, these types of initiatives need to be happening industry wide and with clear accelerated targets to achieve parity and inclusivity.

It just makes business sense

It has been shown time and again that companies prioritizing diversity and inclusivity are 21 per cent more likely to deliver "above-average profitability" and greater long-term value with the key correlation linked to gender diverse executive teams (McKinsey). Why might this be so? Mining companies prioritizing gender parity as a strategic objective possess a diversity of ideas, experiences, cognitive frameworks and expertise that becomes an advantage in a competitive market, e.g. facing volatile commodity prices. A diverse workforce is more adaptable and productive; delivering higher performance for shareholders and stakeholders (McKinsey).

Deloitte also revealed through their 2018 Global Human Capital Trends survey of mining companies, that diversity is correlated "to better performance and corporate decision-making" indicating that leaders today must prioritize corporate diversity and inclusion imperatives.

> CEO and President of Teck, Don Lindsay states, "An inclusive and diverse workforce can lead to improved health and safety performance, increased innovation and productivity, and better decision-making."

Studies have shown that greater diversity at a company can lead to better financial performance, especially when seen at the board and senior management level (Shecter, Barbara, What's a woman on the board worth to stock investors? About 300 bps, according to CIBC study. Financial Post,

2017). Underscoring what inclusivity delivers for better margins, a 2016 PWC study found a higher average profit margin overall (23 per cent) for mining companies with mixed gender boards, compared to the average net profit margin for the top 100 mining companies (20 per cent).

Building the Diversity Pipeline: Recruitment, retention and promotion

While the business case is clear: women in leadership is good for business - the challenge of retention reflected by the extremely high attrition rate of mid-career female talent is a critical issue across the industry.

There have been great efforts by educational institutions like the Department of Civil and Mineral (our graduating class was 35 per cent female in 2019) and other initiatives like Vale's Voisey's Bay Underground Training Program (seeing four females of 10 incoming trainees) to attract females to the industry. However, even with increased female recruitment focus, systemic corporate barriers persist stifling women throughout the duration of their career and resulting in a 'leaky pipeline'. This leak has been highlighted most recently through the #MeTooMining movement where female mining professionals have come forward to voice their negative experiences on mine sites, in boardrooms and throughout the industry as well as their reasons for leaving the sector all together.

This pain point is an especially important one for an industry that requires maximum efficiency, resiliency and adaptability in order to survive and thrive. The loss of experience, competencies and decision-making skills residing in these women must be addressed with initiatives to tackle biased corporate culture.

Women face unique challenges in mining compared to their male counterparts, as a study concluded by Women in Mining Canada (Women in Mining Canada, Ramp-Up: A Study on the Status of Women in Canada's Mining and Exploration Sector (Women in Mining Canada, February 2010). The study cited: work culture, lack of mentors, perception of their skills and work-life conflicts as some of the key barriers to female career advancement. In particular, fly-in fly-out mine sites were of concern for family planning and other life commitments the study found.

> "Companies should require, not ask that executives promote, recruit and include women," stated Cynthia Carrol the former CEO of Anglo America (2007-2013).

Where to start? Looking at the percentage of women at each phase of the career cycle is a productive and meaningful way for mining companies to measure the health of their workforce and identify where barriers and biases occur. Monitoring imbalances in gender pay gaps, gender-bias performance metrics, the ratio of eligible women versus promotion rates of women, or their odds of advancement compared to their male colleagues, are all ways mining companies can ensure their business operations are fully supporting and thus retaining women in the workplace.

> There had been unconscious bias in the industry and that women had been disadvantaged. In the company's "most inclusive and diverse sites" performance is 15 per cent higher.

Change comes from the top down

Transforming a culture requires commitment across an entire line of business; but mining company CEO's dedicating efforts to this inclusivity imperative see the greatest results. Building a culture of inclusivity requires the active endorsement, sponsorship and amendment of business objectives by senior leadership. Top executives must be the agent of change to reform the power structure and dissuade systematic unconscious bias. Without this top-down culture shift, on-site employees will never substantively engage, and transformation will not take place. For this change, and its associated boost to company profits to happen in our lifetime, rather than at the current glacial rate of change, we need more women on boards and in leadership positions now.

These concerns are gaining more traction with top mining leadership who are making both the ethical and business case for a dramatic culture shift.

Andrew Mackenzie, CEO, BHP says this about the gender parity goal at their Annual Meeting, "It will demand that we question our own biases when we make decisions, that we make our workplaces more flexible and that we challenge dated stereotypes about jobs in the resources industry." Mr. Mackenzie recently said in an interview with the Sydney Herald, "It is about tapping "the best brains in the planet", Mackenzie says, including younger people "who are at their most productive, their most inspirational, their most quick-thinking, their most quick-witted – we need to be attractive to them by having a modern approach to sexuality and race and inclusion. When they get here there should be absolutely no discrimination, and a sense that they can flourish."

Around the world, countries are taking notice of the sizable deficit of female representation on boards. Though not strictly focusing on mining companies, the emphasis on gender parity through legislation associated with mandatory quotas or comply-explain regimes is sparking much debate.

While quotas can be helpful to provide measurable targets, there must be meaningful change for gender parity to take hold and transform a business. Women's qualifications must hold equal weight to their male counterparts. The persistence of the 'old boys network', must make way for equitable appointments based on merits. With only 16 per cent representation in the overall workforce, women's networks are limited, and male champions are needed to create dial-moving solutions.

> "Gender diversity isn't just a buzzword of the moment, it makes good business sense to have a workforce that is made up of the best male and female talent out there," Asanko president and CEO Peter Breese said.

The Lassonde Institute of Mining

> *As men, early in our career or later on in our career, we need to take every opportunity to come alongside our female colleges and support and advocate for them. We need to listen and champion for their efforts and realize it is everyone's responsibility to make this industry welcoming to all. Having women in this sector makes us smarter and more resilient for a future where vital resources are critical.*
>
> *Ian Pearce (Chair of the Board, New Gold; Director, Nexa Resources; Vice Chair, Outotec and Chair, MineSense Technologies).*

Ian Pearce, an active industry advisor and champion for the Lassonde Institute, works alongside an all-women leadership team and first-ever woman director, Professor Lesley Warren, to develop a new vision for the 20-year old Institute.

Gender parity is not just seen at the L/I leadership level, but also in our top research pool of principal investigators. Over 50 per cent of our L/I principle investigators are women. This feat, the likes of which other mining programs and institutes have not yet achieved, has been made possible by the catalyzing efforts of Dean Emerita Cristina Amon of the Faculty of Applied Science and Engineering at the University of Toronto. Her persistent championing efforts towards diversity, inclusivity and parity within the Faculty additionally supported by Department of Civil & Mineral Engineering's chair, Professor Brent Sleep, have made this positive change possible at the Lassonde Institute.

The future of mining depends on diversity in mining

A diverse mining industry will mean a workforce that is flexible, adaptable and well prepared to tackle uncertainty. Canada's mining sector could and should be global leaders in driving this transformative change. The facts tell us that in the process, they would gain significant competitive advantage and position themselves to reap massive rewards.

By **Lesley Warren**

Lesley Warren is the Director of the Lassonde Institute of Mining. She holds the Claudette-MacKay Lassonde Chair in Mineral Engineering.

The Lassonde Institute is continuing to expand with the addition of new Principal Investigators in emerging mining fields and new global initiatives launching this year 2019-20. Learn about our future events and updates by visiting lassondeinstitute.utoronto.ca/join-the-lassonde-institute-mailing-list to sign up for our community emails.

RECENT GRADS: WHAT ARE THEY UP TO NOW

NICOLE DOUCETTE (MIN 1T4+PEY)

"Be relentless and do what makes you happy," says Nicole Doucette (MinE 1T4 + PEY) giving direction to current students for their professional goals; while in school, "Just really enjoy 'you time' in university. There's a lot of freedom, and many opportunities while in school, so students should take advantage of their situation to get involved."

Doucette works in the Vancouver office of Seequent, a mining software company based in New Zealand, as a science communicator and writer. "It was a really great opportunity for me, because it was the first time I was able to combine what I love, which is writing and communications with my actual background in mining."

Further explaining Seequent's forte, she says, "We create geoscience analysis modelling and collaborative technology. Probably our most well-known product is Leapfrog Geo, which is used for 3D geological modelling in the mining and minerals industry, primarily in exploration."

Photo by Cathal Phelan

While studying mineral engineering at the University of Toronto, Doucette's experience involved a Professional Experience Year (PEY) at a company in Calgary, taking her out of the province for the first time. "It was really great to see how a lot of the applied knowledge I was getting in class was actually implemented in industry. I got to see what the industry was like, and decide if the oil and gas sector was for me, or if I wanted to go into the hard rock sector."

Serendipity played a part in getting to where she is now,In reflecting upon what other direction her academic or professional career might have gone, such asthinking she might have liked to takinge some classes in journalism,so Doucette ponders, "It's hard to know if I had taken a different path, if I'd be where I am now."

Still, she's firm in the belief of following her own interests and goals in order to find her own path.

"One project I do in my spare time is a podcast called DYNOmine. I did one episode to test the waters early - it was about what we can do better for equality across the whole industry. Though it was about women in a remote mining camp, it's not just for women. It's kind of close to my heart."

A newer project is in the works too, "I'm working on a big podcasting project right now that will be shared more with the public later."

Some thought-provoking vignettes from the shared experiences of women in remote mining camps bring some sage advice for the industry from Doucette: "Start by asking your colleagues what respect means to them. If you see something inappropriate happening at work, take the person aside and explain to them what was wrong about the interaction. Small actions like these culminate in a very powerful way. All of the challenges we face in mining are not going away and no one else is going to change it for us."

With a career now no longer directly involved in engineering, Doucette reflects, "I wanted to be a science writer for National Geographic when I was small, and I'm working as a science communicator now, so you could say everything's kind of come full circle."

PIA DIMAYUGA (CIV 1T8)

Pia Dimayuga takes a break on a walk along the Pelican Rapids on Lac Seul First Nations. (Photo courtesy of Pia Dimayuga)

Pia Dimayuga (CivE 1T8), a Civil Engineering MASc candidate, has a long history of travelling afar to lend assistance to others. Her current role looking at air transportation and infrastructure challenges for isolated First Nations communities in Northern Ontario is in line with her early altruistic endeavours.

In elementary school she spent time volunteering with her church group and continued on, as a youth with the Interact Club, going on a mission trip to El Salvador. Her volunteerism and drive, "To leave the world in a better condition," resulted in recognition and thanks from Governor General David Johnston at a 2013 event in the Ottawa Valley.

The Deep River, Ont. resident heard His Excellency's tale of how even small acts can have far-reaching and lasting effects. According to the Pembroke Observer, an anecdote of watching a magician's trick of turning water into wine, with a hidden dropper of red dye, was a light bulb moment. "That one molecule of red vegetable dye interacted chemically with all of the other molecules, turned them and changed the culture of the medium," the Governor General said. "When each of us does something within our means to help the next person, it changes the whole culture and that's what is so special."

Dimayuga's words from that day, as reported by the Pembroke Observer, still hold true. "It gives me a great sense of joy to give back to the community. I have been blessed, so to be able to share my time and talents feels good, and I've learned so much from the people I've worked with."

Pia Dimayuga (right) and Neda Maki take a canoe ride after the second day of the Innovation Station Conference intended to bring together people from Sioux Lookout, First Nations and university researchers.

Dimayuga emphasizes her part is just a portion of a larger issue, "My research is a small piece of a bigger project," she reflects. The current title of the project is *Northern Ontario Air Transportation: Infrastructure Challenges and Effects on Local Communities*.

Air transportation is the only reliable year-round access to many communities. With no roads through the warmer months, the winter ice roads are highly susceptible to the uncertainty of weather conditions, especially with climate change, so air transportation is becoming an even more important lifeline to these communities.

Highly dependent upon outside sources for visiting health care professionals, food shipments, fresh food supplies, travel to medical appointments (to the south) and just about any emergency, an airport is a vital lifeline.

With a majority of the isolated communities having only VFR (visual flight rules) airport access means the airport can only operate if there's a line of sight for pilots during daytime, so nighttime conditions or any strong weather system can restrict incoming and outgoing flights. This is obviously a cause for concern in emergency situations.

Infrastructure improvements and modernization for the remote airports are some considerations

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Photo by Phill Snel

Q&A WITH ALUMNUS PAUL TOMORY

Paul Tomory (CivE 9T5, M.A.Sc 9T7, MBA 02) is Executive Vice-President and Chief Technical Officer at Kinross Gold. He grew up in Stouffville, Ont., north of Toronto, as the eldest of seven siblings, and still occasionally dabbles in a family-run maple syrup operation. Now he's at the downtown Toronto headquarters of Kinross, in a new office tower as part of the rapidly expanding skyline of the city, with a view of the nearby Scotiabank Arena and Rogers Centre.

Q: You come from a large family. Did many in your family attend the University of Toronto?

Yes, I'm the oldest of seven. There's six brothers and one girl - all six boys went through U of T Engineering and my sister did Geology at U of T too. My dad's also a U of T Electrical - he graduated '64. His two brothers, they were '61 and '66.

I'm Civil, my next brother did Engineering Science, the one after that is Mechanical. And there are twins - they both went through Civil - and then the youngest one through Chemical.

Q: What was your best experience at U of T - the best memory?

Well, some of the best things memories from the engineering days are the various social things like Frosh Week - you walk around after Labour Day with everyone – arms dipped in the purple dye – that type of stuff sticks with you. Survey Camp was a big part of it too, and just going to various sporting events. The spirit at the time in Civil Engineering was great.

Academically I had a couple of really good professors. My supervisor for my undergrad thesis was a real mentor - Cameron Kenney, who's since passed away. He took me under his wing and had a passion for the geotechnical field.

Q: Did your education match up with your expectations and the needs of your professional life?

Definitely. I have nothing but good things to say about both the programs I did at U of T. The masters program was also interesting because it was done under the auspices of an NSERC (Natural Sciences and Engineering Research Council) - Industrial Postgraduate Scholarship program. I worked with Golder Associates, it was a collaborative research program and also a great way to bridge from academia into the working world. Subsequently, Golder was my first employer.

Q: Do you have any advice, academically, for undergrad students?

The advice I would give someone is just be patient and live in the present. I think there's a tendency these days for people to want the next step right away. Do what you need to do for two, three, four or five years, learn from experience, get a degree of seasoning and wisdom through the process. Don't always look to the next step.

Q: What makes you uniquely qualified for the role that you're in right now? What sort of qualities?

I don't know if I'm uniquely qualified, but one of the reasons I have no regrets about my career path is that in some ways, and it's really serendipitous more than anything else, I never planned it this way. I think people now try to plan out their careers in a really detailed way with certain expectations - by 'year X' I need to be here and 'year Y' I need to be there.

What makes me reasonably well-qualified for my current position is I have an undergrad focused on geotech. My masters was in effect a mining masters with focus on both tailings and underground mining. I then went to work for Golder Associates, an engineering consulting company. Most of the work I did there was focused on heavy civil construction and mining. Again, building up to what I do today.

Q: In your leadership role do you have a particular style?

One of the things I try to do is communicate often and transparently. I like to communicate with the team, both up and down, and laterally. I treat the team as a flat structure. We're all part of a team - there's no hierarchy. And sharing information about strategy, where the company's priorities are, tends to build team.

Q: What's the best part of your current job?

There's a few. One is working with great people. It sounds glib, but we've focused on talent management and getting the right people. We don't have high turnover rates in the technical teams, and it is a great place to work.

Also, I am an engineer, so I'm a bit of a geek in that I like the fact I get to go to mine sites, oversee construction projects and all that. I think working for a multinational company with operations all around the globe is also quite rewarding. And of course, right now gold prices are doing well, so gold is a great place to be.

Q: Is there anything that keeps you up at night worrying?

The most important is, because I have responsibility for operations in the company, the health and safety of our employees, and keeping our first priorities first. Things like health and safety, corporate social responsibility (CSR), our environmental commitments and our sustainability commitments – to the extent that sustainability can be achieved mining. Those are the things that truly weigh on my mind.

Q: Are you doing anything new in the industry?

One of the things we've launched here in the last couple years is an innovation function. We have created almost a Dragon's Den type situation where we have money allocated and people pitch the innovation committee on ideas. They can be big or small. They could be a different way of processing gold, a drone type technology from mapping stockpiles at our pits, or it can be automation. It's exciting.

Q: Have you learned something from a professional mistake?

Though not a specific example, I think there's a temptation or tendency to discount the wisdom and experiences of others. I think you learn the hard way, particularly in engineering, that practical aspects and construction mining, experience counts for a lot. There's a pragmatic aspect and no substitute for on-the-job learning. If I were to do one thing differently, looking back, I would have paid more attention to mentors, and how they did things, and that would have helped accelerate my own learning and development.

That's what I tell people now: Just be patient, learn from those in front of you. Good things will come.

Q: How do you take your Tims coffee?

Double-double!

This interview has been edited and condensed.

Con't from page 35:
that could result in improving connectivity and overall quality of life for the communities.

Working as an inter-disciplinary team researching the air transportation challenges faced by isolated First Nations communities, is an eclectic mix of investigators. Included in the project, funded in part by XSeed (an interdivisional U of T research funding program designed to promote multi-disciplinary research), are U of T professors Shoshanna Saxe (CivMin), Tracey Galloway (Anthropology) and Michael Widener (Geography). Saxe is her supervisor on the project.

In June of this year the researchers presented to Indigenous leaders from across Ontario at the Sioux Lookout Innovation Station. The event was part of the Reconciliation Through Engineering Initiative (RTEI), a collaboration between Indigenous communities and U of T Engineering's Centre for Global Engineering (CGEN). Through this group effort they are "taking a community-driven approach to research and projects in those communities," says Dimayuga. "The group work is important, as it lends a variety of viewpoints and expertise to the project."

"One community has invited us to visit and we're planning to make that happen this summer," explains Pia. "We'll go to three to five communities, depending on how long it takes to develop those relationships." Sioux Lookout, Ont., about 400 kms northwest of Thunder Bay by road, is considered "the hub of the North" by air to some 31 remote First Nations communities, and is where they would base travel from.

"We have to be very respectful of the different perspectives and cultures," Dimayuga remarks in acknowledging the time it takes to earn trust in new communities. "There is a long, complex history with the government, but even with researchers and with the University. There is a long history of extraction of data and extraction of experiences that don't necessarily translate to change in communities."

Reflecting upon her life and general optimistic attitude, "We have a responsibility to try and do good in the world."

2018 2019 Awards & Honours

Faculty

INTERNATIONAL

Sitara-e-Imtiaz Civil Award
Government of Pakistan
Shamim Sheikh

American Concrete Institute
Honorary Member
Doug Hooton

International Association for
Travel Behaviour Research:
Lifetime Achievement Award
Eric Miller

2019 Council for Tall Buildings
& Urban Habitat Innovation
Award for the Viscoelastic
Coupling Damper (VCD)
Constantin Christopoulos and Michael Montgomery (CivE PhD 1T1) of Kinetica

Royal Academy of Engineering Fellow
Paul Young

CANADA

Clean 50: Emerging Leader
Shoshanna Saxe

Engineers Canada
Young Engineer Achievement Award
Jennifer Drake

eCampusOntario Featured Project
Building Science OER Modules team

2019 CSCE A.B. Sanderson Award
Jeffrey Packer

2019 CSCE Sandford Fleming Award
Amer Shalaby

2019 ThinkTransit Award of
Excellence in Innovation
Amer Shalaby

2019 CSCE Fellow
Robert Andrews & Paul Gauvreau

2019 OPEA Young Engineer Medal
Shoshanna Saxe

2019 Engineering Institute of
Canada Julian C. Smith Medal
Heather MacLean

2019 Engineering Institute
of Canada Fellows
Robert Andrews & Jeffrey Packer

Students

Frances Bradfield Graduate
Fellowship in Environmental
Engineering from U of T Engineering
Laura Minet (PhD Candidate)

Placed first in initial round of 2019
ELECTRI International/NECA Green
Energy Challenge Competition
CECA U of T team

The Wesley J. Hall Award for
Excellence in Entrepreneurship at U
of T's Black Graduation Ceremony
Olugbenga Olubanjo (MASc Candidate)

CSCE Donald Jamieson Fellowship
Pedram Mortazavi (PhD Candidate)

G.J. Jackson Fellowship Award
from the Canadian Institute
of Steel Construction
Pedram Mortazavi (PhD Candidate)

2019 Canadian Geotechnical
Society's Southern Ontario Annual
Graduate Student Competition
**Mohammadamin (Amin)
Jafari (PhD Candidate)**

Faculty of Applied Science
and Engineering's 2019
Teaching Assistant Award
Allan Kuan (PhD Candidate)

PEY Student of the Year
Ognjen Kelec (Year 4 MinE)

2019 U of T Gordon Cressy
Leadership Award
**Sneha Adhikari (Civ 1T8+PEY) &
Donna Vakalis (Civ PhD 2019)**

2019 U of T Engagement
in the Arts Award
Allan Kuan (PhD Candidate)

Alumni

Meritorious Service Award for
Community Service
Engineers Canada
Helen Wojcinski (Civ 8T7)

Canada's Top 30 Developers
Under 30 from BetaKit
Hassan Djireh (Min 1T5)

UPCOMING EVENTS

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CivMin Awards Reception

Honouring student award and scholarship recipients

October 2019

Skule™ Lunch & Learn

Urban water provision amidst the chaos of emerging markets - David Taylor

November 13, 2019

CivMin Career Fair

Organizations exhibit and recruit students and recent graduates

January 2020

Iron Ring Ceremony and Reception

Graduating students receive their iron rings

March 2020

Alumni Reunion

Come back to Skule™
Honoured years ending with 0 and 5

May 27-31, 2020

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

January 21, 2020
Julian Marshall

John R. Kiely Endowed Professor of Civil & Environmental Engineering
University of Washington

February 27, 2020
Norbert Morgenstern

Distinguished University Professor Emeritus, Geotechnical
University of Alberta

March 25, 2020
Silvio Baldassarra

Chairman, NORR

April 8, 2020
Diane McKnight

Civil, Environmental & Architectural Engineering
University of Colorado Boulder

April 2020
Jenna Davis

Dept. of Civil and Environmental Engineering
Stanford University

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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.

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