

The Civilian



One Department, Two Great Programs: Civil and Environmental Engineering / Issue 17 / June 2014

Hydrofracking
ENVIRONMENTAL EFFECTS ANALYZED

Green Energy Fixes
FOR DRAFTY DOWNTON ABBEYS

The Civilian

Issue 17
June 2014

Published By
Brent Sleep

Managing Editor
Nelly Pietropaolo

Designed and Edited By
Colin Anderson



- 5 **UTTRI IS BORN**
- 6 **HYDROFRACKING**
- 8 **ADRIAN COOMBS CELEBRATED**
- 10 **MINING GAMES**
- 14 **DONE WINS VALE AWARD**
- 16 **GLOBAL STARTUP BATTLE**
- 18 **GREEN CONCRETE**
- 20 **COMING EVENTS**



What a great tradition to establish. I am so proud of the leadership role U of T Engineering has taken.
- An End to Bullying, Page 11



I am writing this from the CSCE 2014 Annual Conference in Halifax where the conference theme is Sustainable Municipalities. In this Chat you will get a sample of some of the recent activities in our Department related to sustainability, including highlights of research on hydraulic fracturing for fossil fuel derived energy production, initiatives on transportation to reduce congestion and transportation-related energy consumption, and innovations in building science to reduce the carbon footprint of ageing buildings.

A recent report from an expert panel that included Professor Paul Young from our department calls for more research on the potential impacts of hydraulic fracturing for extraction of shale gas. Research under way at the newly formed University of Toronto Transportation Research Institute (UTTRI) brings together experts from engineering, economics, policy, urban geography and planning, and computer science to tackle traffic congestion, reducing commute times, fuel consumption and pollutant emissions.

I am sure that many of you will have read some of the stories in the media about the MARLIN smart traffic light system developed by Professor Baher Abdulhai and Dr. Samah El-Tantawy (recently recognized with a UofT Inventor of the Year Award). Work in Professor Heather MacLean's group by PhD candidate Jason Luk examines the use of bioenergy to power vehicles from conventional to electric. Those of you who attended Professor Kim Pressnail's seminar before the alumni dinner will have heard about the building science innovations in the energy-efficient Gemini house.

These are just some of the examples of transformative research in the department addressing the major challenges facing us in the 21st century.

Our students have had an event-filled year academically and in extracurricular events, from the Concrete Toboggan Competition to the Canadian Mining Games (where our Lassonde Mineral Engineering students excelled). CIV Club and the Civil Engineering Graduate Student Association partnered to raise over \$1500 for the Hincks-Dellcrest Centre, a local children's hospital. This year we will host 168 undergraduate students at the 94th Annual Camp.

As always, I extend an invitation to you to visit us and find out what's new and exciting. Our students would also love to meet you and hear about your careers in civil engineering.

Best wishes for a great summer!

Brent Sleep
Professor & Chair
Department of Civil Engineering



Concrete > Steel

Why is reinforced concrete still so dominant in Brazilian structural engineering projects?

In developed countries including Canada, England, and the United States, metal is often preferred over reinforced concrete in structural engineering.

Metal structures require fewer labourers, reduce material waste and construction site clutter, and are less susceptible to field work mistakes. Despite these considerations, reinforced concrete is the dominant material used for structural construction in Brazil.

The majority of construction labourers in Brazil are unskilled, untrained workers who earn very low salaries. According to Francisco Ferreira Cardoso, Civil Engineering professor at the University of Sao Paulo Politechnical School (Poli-USP), 80% of Brazilian construction workers have less than 4 years of schooling, 20% are illiterate, and 70% have never received technical training.

Metal structures require significantly fewer labourers with more technical skill, and the adoption of metal in structural engineering could result in significant unemployment in this industry.

Brazilian engineers disagree about the financial viability and merits of using metal structures.

The material cost of metal is much higher than that of reinforced concrete in Brazil. Julio Fruchtengarten, a professor of Metal Structure at Poli-USP, believes that steel structure can increase the total cost of a project by 20%.

However, according to structural designer Yopanan Conrado Rebello, the greater strength-to-weight ratio of metal leads to great savings in foundation construction and a reduction in material waste, and the final cost does not differ greatly between metal and reinforced concrete structures.

Brazil does not have a tradition of using metal structure, and civil engineering programs at Brazilian universities offer far more courses in reinforced concrete than in metal structures.

As a result, most Brazilian engineers are not prepared for, lack adequate knowledge of and are prejudiced against the use of metal in structural projects.

For social, economic and educational reasons, Brazil continues to use reinforced concrete in structural engineering.

Gabriel Costa Valenca
TORONTO

Gabriel is one of about 230 Brazilian undergraduates currently studying in the Faculty of Applied Science and Engineering on an official exchange through the Ciência sem Fronteiras (Science Without Borders) scholarship program organized by the Brazilian Ministry of Education and Ministry of Science and Technology.

Students in the CsF program are enrolled in academic programs enriched with intensive english language instruction as well as an industry or research work placement during the summer term.

The 14-16 week summer placement is a mandatory component of the CsF program at U of T. The CIE's CsF Office oversees this aspect of the program and supports students in finding a meaningful placement through workshops, internal placement processes, collaboration with placement agencies, and ongoing one-on-one student support.

STAY IN TOUCH! We welcome your letters, stories, and updates sent to cd.anderson@utoronto.ca. We respond to everything you send and will publish what we can.

Photo: Professors Baher Abdulhai and Matthew Roorda in the state-of-the-art Intelligent Transportation Systems Centre and Testbed, one of the facilities at the centre of the new University of Toronto Transportation Research Institute.



"Considerable expertise exists across U of T's three campuses with respect to transportation, urban planning and design, urban economics and finances," said Eric Miller (CivE), Director of the new Institute and former Director of the Cities Centre at U of T. "This expertise will be tapped as UTTRI expands beyond the Department of Civil Engineering and the Faculty of Applied Science and Engineering to become a university-wide research centre."

UTTRI is the latest in a series of cross-disciplinary, cross-University research and education initiatives. Housed within U of T Engineering, the centre involves researchers from Engineering, the Department of Geography and Program in Planning, the Department of Computer Science, the Martin Prosperity Institute at the Rotman School of Management, the Munk School of Global Affairs and the School of Public Policy and Governance.

Interest in transportation and infrastructure research has been growing steadily across many academic disciplines in recent years, and the centralization and coordination of research from disparate areas is one major area of future opportunity.

The Institute's formation enables the Department of Civil Engineering to expand and manage transportation-related research in a number of key areas, like the Data Management Group, which provides transportation data management services to Greater Toronto Hamilton Area (GTHA) transportation planning agencies, as well as to university transportation researchers.

The Transportation Tomorrow Survey, the largest on-going urban travel survey in the world, the Travel Modelling Group, which undertakes applied research and development work to support on-going improvement in regional travel demand forecasting by GTHA transportation planning agencies, and the Intelligent Transportation Systems Centre and Testbed, a major computer lab supporting advanced transportation system analysis and modeling, will also fall under the auspices of the Institute.

UTTRI builds on a 40-year history at U of T Engineering in conducting research on significant Canadian transportation issues. It began with the Joint Program in Transportation, and its successor, the Urban Transportation Research and Advancement Centre.

With the University's unrivaled facilities and vibrant research community and the City of Toronto's ability to provide a unique urban laboratory – the University of Toronto Transportation Research Institute has the talent and collaborative opportunity to become the premier transportation research centre in Canada.

U of T Engineering Leads New University Wide Transportation Institute

As cities around the world grow in size and influence, there is one word that increasingly irritates politicians, city workers and daily commuters – it's one word that blocks traffic, jams crowds and stops public transit in its tracks.

Congestion.

And a new transportation research hub at the University of Toronto – led by the Faculty of Applied Science & Engineering – wants to break the bottleneck.

Earlier this year, the Engineering Faculty Council formally established the University of Toronto Transportation Research Institute (UTTRI). The new centre brings together experts from engineering, economics, policy, urban geography and planning, computer science and more from across all three campuses.

Collaborators will engage in projects directly with industry and government organizations. Their research will address practical problems in transportation policy and decision-making, using research-based evidence. The Institute will also train highly qualified transportation personnel ready to tackle tomorrow's challenges.

Hydrofracking

Environmental Impacts of Shale Gas Extraction in Canada Analyzed

A newly released report by the Council of Canadian Academies entitled “Environmental Impacts of Shale Gas Extraction in Canada” provides the most comprehensive examination of shale gas development in Canada to date.

This report represents the work of a multidisciplinary panel of experts, of which Professor Paul Young, FRSC, Vice President (Research), and Professor of Geophysics here in the Department of Civil Engineering, was a member.

The Panel considered the state of knowledge of potential environmental impacts from the exploration, extraction, and development of Canada’s shale gas resources.

Their report reviews the use of new and conventional technologies in shale gas extraction, and examines several issues of concern including potential impacts on surface water and groundwater, greenhouse gas emissions, cumulative land disturbance, and human health. It also outlines approaches for monitoring and research, as well as mitigation and management strategies.

“The North American energy landscape is undergoing dramatic change,” the committee said. “Unconventional oil and gas resources are fuelling an energy boom that is having profound economic, environmental, and social impacts across much of the continent, including Canada.”

At the forefront of this change is shale gas, which has been characterized as a “game changer” because it is abundant, often close to major markets, and relatively inexpensive to produce.

Understanding the potential impacts of shale gas extraction is critical for policy makers, industry, and many others as consideration is given to how best to manage the resource.

The committee’s key findings indicate that, although the technologies and techniques used in extracting shale gas are well understood, more research and information is

needed on the potential environmental impacts that could result from this process.

In Canada, shale gas development has moved forward in British Columbia and Alberta while potential development is still being explored in Quebec, New Brunswick, and Nova Scotia.

Unlike the United States, Canadian development has moved at a slower pace. This slower pace of development presents a unique opportunity for Canada to take the time to explore and determine the proper management practices to develop its shale gas resources responsibly.

“For Canada, regional context matters,” say the authors. “Environments, ecosystems, geographies, and geologies are not uniform across the country. Therefore, consideration of different potential regional impacts need to be closely considered when determining the suitability for shale gas development.”

Overall, the Panel found that more well-targeted science is required to ensure a better understanding of the environmental impacts of shale gas development.

Currently, data about environmental impacts are neither sufficient nor conclusive.

The assessment focused on a number of environmental impact areas. On well integrity, the panel noted that natural gas and fluid leakage from wells due to inadequate cement seals is a long-recognized yet unresolved problem that continues to challenge engineers.

Leakages could lead to impacts for both water and GHG emissions. As shale gas development requires a high density of wells to sustain a stable production rate, the need for well integrity is paramount, especially in areas that depend on groundwater for potable water supply.

Improved technologies as well as long-term monitoring are required to manage impacts.



The Panel also placed significant focus on both groundwater and surface water during its review.

Most experts agree that impacts on water raise the greatest environmental concern from shale gas development. Risks exist for both potable groundwater and surface water.

The greatest threat to groundwater is gas leakage from wells for which the impacts are not being systematically monitored and predictions remain unreliable.

Potable groundwater can also be at risk from underground pathways for gases, fracturing chemicals, and saline fluids that migrate upwards.

Other water-related concerns include accidental surface releases of chemicals, the amount of water needed for development, and disposal of wastewater. Proper management and continued monitoring can help mitigate some of these risks.

Large-scale shale gas development may represent the start of decades-long industrial activity. As such, cumulative and regional effects on land resources and use will need to be assessed. Potential effects can include such things as the development of infrastructure near well sites.

It should be noted that practices currently exist to reduce the land footprint of shale gas development.

Most experts judge the risk of seismic events triggered by hydraulic fracturing or by wastewater injection to be low. Both risks can be diminished through careful site selection, monitoring, and management.

Human health and well-being may be affected by various environmental effects (e.g. air and water quality) resulting from shale gas development. However, health impacts are not well understood and additional research is required.

Many within the public are skeptical of shale gas development. Lack of transparency can lead to a perception

that industry or regulating authorities are not forthcoming. Therefore, the panel recommends that attention be paid to ensuring open and transparent communication regarding shale gas development.

In many instances to date, shale gas development has proceeded without sufficient baseline data.

The report underscores that reliable and timely information is essential to manage potential environmental effects. The Panel also found that possible environmental and health effects of shale gas development may take decades to become apparent, underlining the need for long-term monitoring.

This report comes at the request of Environment Canada, which asked the Council to assemble a multidisciplinary expert panel to consider the state of knowledge of potential environmental impacts from the exploration, extraction, and development of Canada's shale gas resources.

The Expert Panel was not asked to conduct a safety assessment, determine the economic feasibility of shale gas development, or compare energy sources.

The Council of Canadian Academies is an independent, not-for-profit organization that began operation in 2005.

The Council supports independent, authoritative, and evidence-based expert assessments that inform public policy development in Canada. Assessments are conducted by multidisciplinary panels of experts from across Canada and abroad. Members of the Council's blue-ribbon panels serve free of charge.

The Council's vision is to be a trusted voice for science in the public interest.

The full report is available for download, free of charge, on the Council's website (www.scienceadvice.ca).

U of T Women Engineers Lead by Example

ADRIAN COOMBS (CIVE 8T9) CELEBRATED



Whether we aspire to be a leading academic or a corporate tycoon, very few of us could travel our career path without a bit of navigational guidance from those who have gone before us – leaders who inspire or motivate us, merely by example.

Last month, the NSERC Chair for Women in Science and Engineering asked female engineers in Ontario to identify outstanding role models who have influenced their careers.

Nearly a third of the thirty women selected for an online feature were alumni or faculty from U of T Engineering, including Adrian Coombs (CIVE 8T9).

Adrian works for the Region of York as Senior Project Manager on water and wastewater projects, going through environmental assessments, design and construction – for linear infrastructure, pumping stations, a treatment plant, elevated tanks and reservoirs.

She manages the activities of consulting teams that she has hired through a competitive process. She is York Region’s public and professional face on many projects, dealing with agencies, residents, NGOs, First Nations and stakeholder groups.

Adrian was a stay-at-home mother who grew a highly successful and rewarding career as a Girl Guide leader and trainer. Looking for her next challenge, and with the support of her husband and daughter, she followed the advice of a

career counsellor, who suggested applied mathematics or engineering.

The latter, civil engineering in particular, sparked her interest and imagination resulting in a return to university as a mature student, and seven years of part-time study, during which she balanced her home life and girl guides.

She persevered and eventually earned her BAsC in 1989, in her mid-forties.

“Generally those I manage, who work with me, have gone on to grow their careers,” she says of the mentorship she provides. “One moved from technician to project coordinator with more responsibility and independence – because I provided opportunities to manage small portions of a project on her own. Another revived her career and qualifications as a planner and moved from working with me as an administrative assistant to a responsible position as a planner with a larger salary! I treat people with thoughtfulness, constructive feedback, and strive to learn what their goals are – the golden rule – as I would like to be treated.”

Want to share your success? Join the Skule Mentorship Program!

Are you a Skule alumnus who has found success through your engineering career? Do you want to help future engineers succeed? If you answered yes to either of these questions, you may be

a perfect match for one of our Engineering students in the Skule Mentorship Program.

Skule alumni are integral to helping us foster the next generation of global engineering leaders through this program. By sharing your professional experience and insight with third- or fourth-year Engineering students, you not only enhance their educational experience,

you also give back to your alma mater in a unique and rewarding way.

Mentors and students are carefully matched with a 3rd or 4th year student.

For further details, please contact Megan Murphy, Volunteer Leadership & Recognition Officer, at 416-978-4941 or by email at meganm@ecf.utoronto.ca.

TTC's Andy Byford speaks to engineering students: LEADERSHIP SKILLS ARE KEY



Although he doesn't have an engineering degree and admits to being hopeless at constructing IKEA furniture, Andy Byford, head of Canada's largest transit system, knows that engineers with savvy leadership skills are a force to be reckoned with.

"Engineering as a discipline is amazing," say Byford, TTC CEO, who joined over 80 University of Toronto students on campus this spring, "because [they] have to have an ability to think under pressure... think logically... see the bigger picture and be able to grapple with complex equations."

Students with an engineering degree can aspire to the top career positions, Byford told students, but only if they "can combine the fantastic skillset engineers have with the softer skills." He focused heavily on people management and customer service abilities.

Hosted by U of T's Institute for Leadership Education in Engineering (ILead) as part of National Engineering Month, Byford brought some of the TTC's biggest challenges with him. In small groups, students debated solutions to popular transit topics, like: 'Subways, streetcars or buses?' to 'How do you best allocate the TTC's limited funding?'

They also engaged Byford through an informal question period, where they could ask questions about his leadership and experiences at the helm of the TTC. This allowed them to further explore his rise through the ranks of transit authorities in the United Kingdom and Australia.

"I think where the [London] Tube, and definitely the TTC, went wrong in the past was there was an absolute focus on engineering and on the disciplines of engineering – so actually just looking at the way the machines worked, and not paying enough attention to the softer side."

Working closely with Byford, the goal was to have students see beyond the technical specifics of running the TTC, and critically understand the many aspects of leadership in large, complex organizations.

"It wasn't what I expected. He was really down to earth," said Master of Engineering student David King (CivE), who had a chance to share his recent research with Byford.

King is using pedestrian microsimulation to examine how

slight changes in pedestrian behaviour – like moving people to the back of a bus – can greatly limit transit delays.

Another idea of his that he got to chat about with Byford was recently featured in the Toronto Star: co-ordinating train arrival and departure times on different lines.

Take the massive Bloor-Yonge interchange station, for example. "You can find out how long it takes people to walk from the eastbound train to the southbound platform," he said.

"That way, a train is always leaving a platform as the next wave of passengers arrive, cutting down on the number of people waiting in the same place. The TTC doesn't have the signalling infrastructure to do this, but it has worked in other places like Hong Kong."

"You expect CEOs to have a stiff upper lip, but that's not what you get with [Byford]," King said. "It's a refreshing take, and I think it bodes well for a future vision for the TTC and our city."

The Institute for Leadership Education in Engineering (ILead) provides transformative learning opportunities so that students and professionals can develop success skills.

ILead empowers the whole engineer to maximize their potential and contribution to the local, regional, and world-wide community.

ILead undertakes student programming, academic and industry-focused research, as well as outreach to engineering leadership educators and engineering-intensive enterprises.

MIN Students Exceed Expectations at Games

24TH CANADIAN MINING GAMES AT L'UNIVERSITE LAVAL

University of Toronto's Lassonde Mineral Engineering students set lofty goals for themselves as they entered the 24th Annual Canadian Mining Games this spring, and they did not disappoint.

The student team of 16 outperformed their own expectations, receiving 12 awards in a variety of events like mine rescue, mineral identification, and sustainability.

The team was most proud of their performance in subsurface mine design and mine rescue events, which were a target for the group going into the competition. "Four team members are assigned to design a mine and compile a full technical report in eight hours," said Oleg Shteyner, a member of the U of T team that competed in the event. "We prepared beforehand and worked really hard to win the gold. It was very stressful and we had some technical difficulties, but we ended up delivering the best design."

MIN students Mike Chen and Andreas Steckenborn captained the team made up of students in their second, third, and fourth years.

They brought with them experience from previous Games and the technical knowledge to take on the wide range of challenging events, adjudicated by leading real-world mineral engineers.

The team placed first in six events, including mine design, a mine rescue simulation, mineral identification, a stock market investment challenge, the examination, and health and safety. They took silver in surveying, mechanical design, mineral processing, sustainability, and mine trivia. They also took bronze in the speech contest.

This year's Canadian Mining Games was hosted by L'Université Laval in Québec City. The four-day showcase saw teams from 10 universities compete in a spirit of friendly rivalry. An annual event, the Games bring mining and mineral engineering students together with industry leaders to challenge their skills and professionalism.

It serves as a major employment, networking, and educational event for students in the discipline.



The Wright Stuff

COREY WRIGHT (MINE 1T5) RECOGNIZED FOR VARSITY ATHLETIC EXCELLENCE

When it comes to solving complex problems, some of U of T's engineering students take it from the classroom to the playing field.

At the ninth annual President's Reception on March 28, four engineering students including Corey Wright (MinE 1T5) were awarded Silver T awards, a prestigious honour given for outstanding athletic performance in their graduating year.

At this year's event, President Meric Gertler presented 23 Varsity Blues athletes with the award. Founded in 2006 by former president David Naylor, the reception celebrates athletic excellence at the University.

A fourth-year defenceman, Corey has led Toronto's men's lacrosse team to consecutive playoff berths in each year he has played. Wright is a three-time Canadian University Field Lacrosse Association all-Canadian and ends his four-year career with 16 goals and 16 assists in 44 regular season games.

Faculty Registrar Barbara McCann—an avid tennis player and runner who understands the benefits of sport—applauded the achievements of U of T Engineering's varsity athletes. "I appreciate our varsity athletes' efforts to excel in both their sports and demanding engineering programs."

An end to bullying, one pink shirt at a time

Pink shirts, pink balloons, pink cupcakes – and a cannon.

On February 26, hundreds of U of T Engineering students, staff and faculty headed to the Sandford Fleming Atrium in support of Pink Shirt Day, a growing cross-Canada initiative to stop bullying.

Hosted by Engineering Positive Space for the second year at U of T, the pink-shirted participants gathered to celebrate diversity and constructive relationships. Passing students stopped to inscribe anti-bullying messages on helium balloons, while others enjoyed pink desserts supplied by Veda, an Indian restaurant with a

location on campus, and mingled amongst each other in a shared positive spirit.

The event also went off with a bang.

The Lady Godiva Memorial Band and the Cannon Guard made a special appearance to fire the Skule Cannon. If the ear-splitting sound wasn't heard beyond the building's walls, their joyous musical march certainly was.

"What was most gratifying to me," said Peter Weiss, Senior Lecturer and Director of the Engineering Communications Program, "was the extent to which we heard, when planning and asking for the participation of groups like LGMB, Cannon Guard or Veda: 'Yes. Of course. This is a tradition!'"

"What a great tradition to establish. I am so proud of the leadership role

U of T Engineering has taken in promoting inclusivity in the Faculty, in the university and beyond."

Pink Shirt Day began in 2007 when a group of Nova Scotian teenagers wore pink shirts in protest of homophobic bullying at their high school.

Since then, the one-day celebration has spread across Canada and beyond.

"Bullying is a major problem in our schools, workplaces, homes, and over the Internet," say Pink Shirt Day representatives. "We will be helping raise awareness on these issues and... all the tools needed to stand up against bullies and step in when we see it happening."

Learn more about Pink Shirt Day and its role in education at www.pinkshirtday.ca



Green Energy Fixes for Drafty Downton Abbeys

NEW TECHNOLOGY BRINGS ENERGY EFFICIENCY TO VICTORIAN HOUSE

Bright and early on a frigid winter morning, three-time U of T alumnus Russell Richman pulls his bike up to 31 Sussex Avenue on the University of Toronto's downtown campus.

The grand Second Empire home in a quiet residential neighbourhood in the shadow of Robarts Library doesn't just house a research collaboration between U of T and Ryerson University: it is the collaboration. Known as Gemini House, the historic building has been completely retrofitted to new, groundbreaking energy efficiency specifications. Researchers hope to develop a cost-effective method of achieving superior energy performance in buildings through the use of a thermal envelope surrounding a core space – and their work is already garnering attention. (Read a Globe and Mail article about the Gemini House.)

"What's the guess?" asks Richman, an associate professor with Ryerson's sustainable buildings group.

"It has to be at least 2.5," replies Ekaterina Tzekova, a PhD candidate in civil engineering at U of T and new tenant at the University-owned property.

"I'm going to guess two," says Kim Pressnail, Tzekova's supervisor and professor of building science at U of T.

"1.7," offers another student. "I'm 1.6," says yet another.

They post their best guesses on the refrigerator as they get to work preparing the day's experiment: measuring the rate at which Tzekova's new home leaks. The higher the number, the leakier the home.

Measuring leakage is one way that the research team will be able to establish a baseline for energy savings. At peak efficiency, a house should be almost air-tight.

The researchers use a "blower door" - a giant fabric seal over the front door with a high-powered fan at the bottom - to push air out of the house, creating an air pressure differential of about 50 pascals between the outside and the inside.

They then use sensors on both sides to measure how long it takes for the house to leak in enough air to return the house to equal pressure.

They speak of it in air changes per hour - that is, the house is leaky enough that the entire volume of air in the house is being replaced by that factor every hour through cracks, holes and unsealed entranceways.

The leakier the house, the more warm air it will sacrifice in the dead of winter and the more energy owners will need to use to keep warm.

Reducing leakage is harder than it looks, and a lot more complicated than simply closing windows tight. Tiny faults in insulation, points at which services like electricity, gas and water are delivered, and imperfect ventilation systems are all common leakage points.

A typical "energy efficient" house in Ontario leaks about 2.5 times its air volume every hour.

The Gemini researchers are hoping to get their house under two. That's no small feat, considering that the house was built in the 1870's. The solid masonry house included original window fixtures, outdated building materials and single-paned glass. It was built to be heated with a single wood fireplace.

Retrofitted over the last year, the home now boasts beautiful triple-paned windows inside the historic outer frames and light tubes that gently diffuse the Sun's natural rays deep into the kitchen and hallway areas, eliminating the need for daytime electric light. Efficient in-floor heating cuts down on the need for wasteful, forced-air temperature control.

"We're separating the need for fresh air from the need for heat," Pressnail explains as he warms his toes on the hardwood. "It allows us to control temperature zones more efficiently. When we blow air for heat we create pressure differences that encourage energy leakage. With this system we can turn heated zones on and off easily and we can provide fresh air right where and when we need it."

Traditional heating strategies blow warm air all over a house, including spaces that occupants never use. Here, wireless sensors around windows, doors and other parts of the house talk to computers with building science analysis software, recording relative humidity, temperature, and other relevant energy-use information.

Photos: New energy-saving features in GEMINI House include sealing interior doors and natural light portals that feed the interior of the house with natural, diffused sunlight without the leakiness of a standard sun roof.

It's all designed to allow Tzekova to run her core house spaces at comfortable temperatures all year long, nested inside the larger, less conditioned structure with peripheral spaces that are not as frequently needed.

The grand ballroom, for example, (pictured right) is a wonderful space for entertaining guests on a winter's evening. But it is not the kind of space you'd naturally find yourself drawn to in a house like this one.

With plenty of cozy alternatives on quiet evenings in, the ballroom can be entirely sealed off behind high quality internal glass doors and made part of the perimeter zone, a buffer against the season's harsh climate. So too could extra bedrooms, pantries, mud rooms or basements in similar houses.

Today's blower door test will allow the researchers to determine where work still needs to be done to prepare the house before it goes online in the near future.

The next step: seal things up and have a full analysis running in time for winter's coldest nights.

Based on early models, Tzekova, Pressnail, Richman and the rest of the team predict their Nested Thermal Envelope Design™ will result in net energy reductions of 67 per cent over a typical house built to code in Ontario today.

That's good for homeowners' pocketbooks, and for the environment.

"It's a good news story," says Pressnail. "We don't want to criticize what has been built in the past. We want to say 'look at what we can build in the future.' If we can do it at this heritage property, we can do it anywhere."

For more information on the Gemini House project or to arrange a tour, contact Professor Pressnail, Department of Civil Engineering, University of Toronto, at (416) 978-1501 or pressna@civ.utoronto.ca.

View photos at <http://uoft.me/gemini>



Awards and Honours

Romy Done (MinE 1T7)

2014 VALE UNDERGRADUATE ENGINEERING SCHOLARSHIP

Volunteer, leader in her community and ambassador for the engineering profession – these are the qualities exemplified by Romy Done (MinE 1T7). Romy and two other outstanding women were chosen recipients of the 2014 Vale Undergraduate Engineering Scholarships and were selected from applicants across Canada.

The prestigious \$10,000 scholarships are awarded annually to the most promising women in an accredited undergraduate engineering program in Canada who are interested in the mining and metallurgical fields. Competition was fierce this year, with many outstanding applicants.

But even among the very best, Romy stood out.

She is actively involved in her communities, volunteers many hours to helping others and is a strong role model for the mining engineering profession.

Romy is a first year student in the Lassonde Mineral Engineering program at the University of Toronto. She has spent time traveling internationally, learning other languages and cultures, while at the same time promoting Canada as one of the world's mining capitals.

As a British Columbia Hydro Energy Ambassador, she has been very involved in environmental initiatives and groups.

Romy says, “The state of the earth is extremely important to me and my environmental values align strongly with the mineral industry’s commitment to sustainability. The mineral industry is a perfect example of scientific and social advancements from the equipment used to the environmental commitments.”

Since 1990, the Foundation has promoted engineering as a career choice for young Canadian women through its extensive scholarship program, a website that attracts thousands of new visitors a month, social media programming, and via scholarship winner presentations to high school students. Vale was a founding partner with the Foundation and it is through Vale’s support these two important scholarships are available.

“Vale would like to extend our sincere congratulations to [the winners] – their academic success, commitment to



their communities, and passion for engineering will serve as a strong foundation for future success,” says Tracy Aitchison, General Manager Human Resources at Vale.

“Vale is committed to building a better future – investing in this scholarship is just one of the many ways we promote higher education and the career possibilities in the mining industry. On behalf of the leadership team at Vale, I extend sincere congratulations to this year’s recipients.”

Along with the financial support, Vale may also offer a summer job opportunity to its scholarship winners.

Thanks to Vale’s support, the winners will receive their scholarship certificates at the CEMF Networking and Award Event held in conjunction with the Engineers Canada AGM.

Photos: Romy Done, MinE 1T7.

Across: Jason Luk studies the energy cost relationships in several vehicle mode choices faced by consumers.

Connaught Fund Supports Field Testing of Smart Traffic Light Technology

Prof. Baher Abdulhai's research into MARLIN, the traffic light that uses artificial intelligence and game theory to teach itself about traffic patterns, speak to other traffic lights, and dramatically reduce road congestion, has received a major funding boost from the Connaught Innovation Award Program at the University of Toronto.

The Connaught Innovation Award has invested \$100,000 toward the commercialization and field-testing for the device, which could be controlling Greater Toronto Area intersections in the months to come.

The "smart traffic light" is the result of work conducted by Abdulhai and his research team, including Dr. Samah El-Tantawy, who won several international dissertation awards for her work on the project as part of her PhD program at the University of Toronto.

The idea could save people time and money by dramatically improving traffic flow by up to 75% for existing intersections, streets, and roadways while reducing the city's traffic maintenance and infrastructure operating costs. It may even help save the environment, cutting emissions by 30%.

The idea of intelligent traffic infrastructure is not a new one. What makes MARLIN unique is the decentralized placement of intelligence within each traffic light, avoiding the need for expensive communication infrastructure and a centralized control room staffed by highly trained people. This means cost savings and enhanced reliability over current products on the market today.

MARLIN has been extensively lab tested at the University of Toronto's state-of-the-art Intelligent Transportation Systems Centre using high-fidelity simulation models of downtown Toronto and Burlington, Ontario.

Connaught funds will be used to validate the lab results in field trials, enabling solid business and marketing plans for large-scale commercialization of MARLIN technology across North America in the years to come.



Giovanni Buzzeo

40 YEARS OF SERVICE

Congratulations and thank you for 40 years of great support to the department!



Jason Luk, PhD Candidate

OUTSTANDING PAPER AWARD

The Institute for Sustainable Energy has announced the winners of the annual Outstanding Energy Paper Awards.

"Ethanol or Bioelectricity? Life Cycle Assessment of Lignocellulosic Bioenergy Use in Light-Duty Vehicles," a paper by PhD candidate Jason Luk with Prof. Heather MacLean and Prof. Brad Saville too one of the honours.

The study reports a life-cycle analysis modelling well-to-pump, pump-to-wheel, and vehicle cycle stages for a range of vehicles including Hybrid Electric, Plug-in Hybrid, Battery Electric, and Conventional vehicles.

The study's energy use and net GHG emissions results contrast with findings in literature, which report better performance on these metrics for bioelectricity compared to ethanol.

The primary source of differences in the studies is related to the development of pathways with comparable vehicle characteristics.

Ethanol or vehicle electrification can reduce petroleum use, while bioelectricity may displace nonpetroleum energy sources. Regional characteristics may create conditions under which either ethanol or bioelectricity may be the superior option; however, neither has a clear advantage in terms of GHG emissions or energy use.

Hybrid Chew Toy / Robot Wins Global Startup Battle

CHEWABLE PROTOTYPE BEAT OUT THOUSANDS OF OTHER PROJECTS

By Brianna Goldberg

They took top spot in a startup contest involving more than 20,000 entrepreneurs across 40 countries.

Now, one of the U of T students who triumphed in Global Startup Battle explains how Pawly – an interactive robot built for the rough-and-tumble chomping of a rowdy dog – won the day.

A durable digital toy that lets owners interact remotely with their pets via smartphone, Pawly was first developed by third-year Civil Engineering student Gordon Dri (CivE 1T5), alumnus and Master of Engineering student Yunan Zhao, and their team of engineers, designers and strategists during an intense 54-hour contest called Startup Weekend: Maker Edition in Toronto.

Startup Weekend events are held across the world in cities ranging from Cape Town and Islamabad to Melbourne and beyond.

Finalists from each weekend move on to a championship round called the Global Startup Battle – dominated most recently by teams with members from U of T.

Pawly - one such informally created project - had placed second at its Startup Weekend behind Griflens, a team developing a set of interactive story beads for children.

Griflens, whose roster included Helen Kula, librarian at University of Toronto Mississauga's Institute of Management and Innovation, went on to take third place overall in the Global Startup Battle while Pawly won the championship.

“The Pawly team is perhaps the best example of what can be accomplished at a Startup Weekend when you combine great skill, motivation and impressive teamwork,” said Chris Eben, founding organizer of Startup Weekend Toronto.

“Their success in this significant annual competition demonstrates that Toronto’s startup community is an international powerhouse. The rest of the world should take note – Toronto is where you want to build your startup!”

Dri spoke with U of T News about the Pawly team’s experience in the global competition.

Tell us about why and how you got involved with the Global Startup Battle...

My journey began at the beginning of third year when I was provided the choice to work for a year through the Professional Experience Year (PEY) program at U of T.

I realized no job seemed like the “perfect fit” and it was then I decided I would create my own job and work for myself.

Coupled with the inspiration that past entrepreneurs (e.g., Andrew Mason, Reid Hoffman, Steve Jobs) provided me, I began my journey as an entrepreneur.

I realized that all great entrepreneurs in the past surrounded themselves with like-minded individuals and fed off their innovation and creativity. Therefore, I wanted to join a community of budding innovators and thus registered for Startup Weekend.

I collaborated with a 10-person team for 54 hours to launch our startup, Pawly. We placed second in the competition for our concept and execution and qualified for the Global Startup Battle.

We competed in this national competition amongst other teams across the globe and came out on top.

What was your experience like at Startup Weekend?

Startup Weekend was a weekend-long, no sleep, high stress, yet exciting marathon. I had the opportunity to work with inspirational, creative, and budding entrepreneurs whom I had never met before.

The event was held at OCAD University and the theme was ‘Maker Edition,’ stressing that startups launch a hardware-related product.

We were given the support of all the resources at the university including woodworking labs, laser cutting as well as the donation of 10 3-D printers by General Electric.

The weekend focused not only on building a product but also market validation, customer development and practicing LEAN Startup Methodologies.

We managed to receive over 100 responses to our Google Survey and received our first sources of revenue in just 54 hours.

What's the most important thing you learned from being part of Startup Weekend?

The most important thing that I learned from the weekend is the power that entrepreneurs have to drive the world forward.

All the great innovations in the past have derived from creative entrepreneurs with a common mission to change the world. Our future is in the hands of us as innovators and entrepreneurs.

What did winning the Global Startup Battle mean for you and your team?

Once my team and I won the Global Startup Battle we were both surprised and excited. The success in this competition validated our concept and we immediately knew Pawly was the start of something big.

As a team we have committed ourselves to an official startup with the goal of developing Pawly and bringing it to market.

The success of this competition provided us visibility which is crucial in the beginning stages of any startup. We have the luxury of approaching media, investors and potential partners with the news that our concept won the largest startup competition in the world powered by Google for Entrepreneurs.

We are currently preparing for the LAUNCH Conference in San Francisco, California held from February 24th to 26th where we will demo our prototype and hopefully attract the interests of investors and partners.

How have you found the 'entrepreneurship' environment at U of T?

The University of Toronto has an exceptional community for entrepreneurship from incubators like the Faculty of

Applied Science and Engineering's Entrepreneurship Hatchery and Creative Destruction Labs to conferences such as the Young Entrepreneurs Challenge.

What's next for you as an entrepreneur?

I will continue working with my team to revolutionize the next generation of pet technology while completing my engineering degree.

I hope to join the team full time through the Professional Experience Year program and again post-graduation. I enjoy learning about new startups and hearing about both successful and unsuccessful experiences of other entrepreneurs.

U of T hosts more than 50 enterprise-fostering courses, programs, labs, clubs, contests and speaker series across its faculties, departments and campuses — and then there are all the innovations developing in informal settings.

U of T ranks No. 1 in North America for number of startups launched. And its roster of spin-off companies driving innovation in Toronto and around the world continues to grow.



Green Concrete

IC-IMPACTS SUPPORTS CANADA-INDIA BINATIONAL COLLABORATION

The India-Canada Centre for Innovative Multidisciplinary Partnerships to Accelerate Community Transformation and Sustainability (IC-IMPACTS) is a funding organization for research collaborations between Canada and India.

It provides funding for research in one of three theme areas: integrated water management, safe and sustainable infrastructure, and public health, that affect both Canada and India.

It was established in 2012 through the Canadian Networks of Centres of Excellence, and one of its goals is to demonstrate technologies and give Canadian companies the opportunity to commercially develop these technologies.

Another goal is to stimulate trade between the two nations.

Professors Shamim Sheikh and Frank Vecchio are working on what some are calling “green concrete” technology.

Sheikh is working on developing durable and more economical structural concepts and innovative life extension techniques to create sustainable and robust infrastructure, while Vecchio is developing state-of-the-art analysis tools for concrete structures.

These projects provide training opportunities for students because these projects are applied and they directly benefit students.

Students also gain the opportunities to collaborate with Indian researchers.

Making Lemonade

ENGINEERING STUDENTS BUILD CAMPUS HOCKEY RINK TO BEAT WINTER BLUES

This year’s frigid winter couldn’t hold our inventive students down. While the weather converted the front campus lawn into a gigantic sheet of ice, students didn’t take long to build wooden boards and nets complete with mock advertisements and the Skule (TM) logo.



The Secret Life of Indoor Air Particles

CANADA FOUNDATION FOR INNOVATION SUPPORTS RESEARCH INFRASTRUCTURE

Forty-four U of T projects have been awarded a total of \$12.1 million from the Canada Foundation for Innovation (CFI) for infrastructure that will advance research in everything from water treatment to cancer.

One of them is led by Jeffrey Siegel of civil engineering. “Exploring the Secret Life of Indoor Air Particles” investigates a little-known threat to human health.

Siegel says there are between 100 and 10,000 microscopic particles in every cubic centimetre of air.

“We can’t see them, but they’re all around us. We’re breathing them all the time. Even if we’re very conservative in our estimates, the average Canadian eats about seven kilograms of dust over a lifetime. And that’s just ingestion. We inhale a lot more.”

Indoor particles can be outdoor pollutants that migrated inside, or they can originate from indoor activities such as cooking and vacuuming. Some particles are benign, but others cause serious long-term health problems ranging from heart disease to lung cancer. Though we know they’re a threat — Siegel says they’re widely acknowledged as the number one environmental health risk — they don’t get as much press as their outdoor cousins.

“Research on outdoor particles has been going on for decades and decades,” says Siegel. “But the average Canadian spends 90 per cent of his or her time indoors. Compared to what we know about outdoor particles, we know nothing about indoor ones.”

Siegel has been working to understand the physical, chemical and biological characteristics of indoor particles — they’re all made up of chemicals that can be analyzed and microbes that can be identified using DNA sequencing. His CFI funding will purchase equipment that will allow him to study the physical characteristics of particles, too. This is important because the size of a particle is directly related to how dangerous it is to human health.

“A particle that is a tenth of a micron long [a micron is one-millionth of a metre] will go very deep into your lung and has the potential to do a lot of damage,” he says. “A particle that is much larger, perhaps a few microns long, will settle in your upper respiratory tract. It might have health effects, but they’re going to be less severe.”

Siegel plans to conduct what he calls “filter forensics,” examining used filters from residential forced air heating and cooling systems. The CFI-funded equipment will allow him to extract filter dust, which can be invisible to the naked eye, and study it. The data collected can be combined with more easily generated chemical and biological data to make more realistic predictions about people’s long-term exposure to indoor particles.

The funding for Siegel’s project, and those of the other researchers, comes from CFI’s John R. Evans Leaders Fund, previously called the Leaders Opportunity Fund. The agency recently renamed the fund in honour of former U of T president Evans, who was also CFI’s first board chair.

“Congratulations to all the winners,” said Professor Paul Young, U of T’s vice-president of research and innovation. “CFI funding has been essential to our ability to attract the world’s best researchers, and has, in turn, allowed those researchers to make progress on some of the most pressing problems of our time.”



Coming Events

Eighth Annual CAMP Reunion

Saturday, September 13th 2014

Gull Lake CAMP, Minden
11:00 a.m. Reception and Lunch

Optional bus available from Toronto while space permits.

Ticket sales and registration:
www.civil.engineering.utoronto.ca/alumni

CIV-GEO-MIN Alumni Dinner 2015

Friday, February 6th 2015

Faculty Club, University of Toronto
6:30 p.m. Reception, 7:40 p.m. Dinner

Ticket sales and registration:
www.civil.engineering.utoronto.ca/alumni

twitter 
follow **civmin**

Department of Civil Engineering
Faculty of Applied Science & Engineering
University of Toronto

Galbraith Building
Room 105 - 35 St. George Street
Toronto, Ontario, Canada M5S 1A4

Tel: 416.978.0945
Fax: 416.978.6813

www.civ.utoronto.ca