

Capstone:
INNOVATIVE
by Design

WEDNESDAY

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12-5 PM



**CIVIL AND ENVIRONMENTAL
ENGINEERING**

Capstone Design Symposium 2017

Davis Centre Fishbowl
(DC 1301)
University of Waterloo
Waterloo, Ontario

WATERLOO | ENGINEERING



UNIVERSITY OF
WATERLOO

CIVIL AND ENVIRONMENTAL ENGINEERING

Capstone Design Symposium 2017

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MTE Consultants Inc.

A MESSAGE FROM

JEFFREY WEST, Chair



Welcome to the 2017 Civil, Environmental and Geological Engineering Capstone Design Symposium!

We are one of Canada's largest Civil and Environmental Engineering Programs, and one of the few Geological Engineering Programs. Research in our department covers a broad range of civil, environmental and geological engineering fields. Our undergraduate programs provide students with a strong knowledge base in mathematics and engineering fundamentals, with increasing emphasis on problem solving, engineering design and interdisciplinary subjects. Our students' academics are supplemented by six co-operative education work terms to provide them with valuable practical experience as young engineers. The students' undergraduate education culminates in their two-term Capstone Design Project, which gives them the opportunity to combine their technical knowledge, design principles, teamwork and communication skills to solve a challenging engineering problem. We are excited to share their work, innovations, and solutions with you.

This brochure provides an introduction to the 2017 Capstone Design teams and their projects. We are proud of our students and their project accomplishments, and we hope that you enjoy meeting the teams and learning about their projects at the Symposium. If you have any questions about the Symposium or our programs, or if you have project ideas to be considered for future capstone design projects, please contact me or our Capstone Design Coordinators.

JEFFREY S. WEST

Professor and Chair

Department of Civil and Environmental Engineering

PARTICIPANTS

CIVIL ENGINEERING

1 AMZD Building Engineering Net-Zero Energy and Building Enclosure Design for UW Architectural Engineering Building

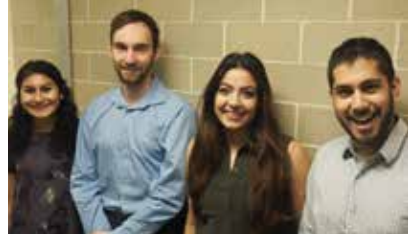
An Architectural Engineering program is coming soon to the University of Waterloo! A field combining architecture and engineering requires a facility that represents the best of the two fields. AMZD is designing an architecturally appealing and engineering savvy net-zero energy building above the existing E2 building. The building's design measures encompass an innovative architectural layout, building enclosure, mechanical system, and occupant controls. These factors allow for an incredibly low energy consumption while also minimizing lifecycle costs.

2 SUNBEAM Environmental Solutions Vertical Farming Structure in Toronto

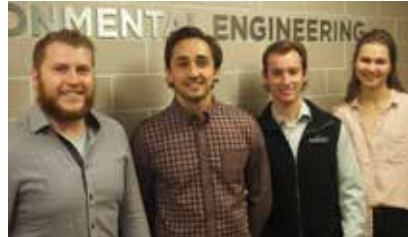
Recognizing the constant growth of Toronto, Ontario and designing a unique and intriguing way of meeting increasing food demand, Sunbeam created an eight storey vertical farming structure capable of meeting interior conditions necessary for plant growth throughout the year. Exciting new materials were used in the design of the building including a plastic material capable of “breathing” to create a desirable environment. Vertical farming structures may very well be the future of agriculture and Sunbeam is at the forefront of the revolution.

3 AEDIFIX Modular Design of a Submerged Floating Tunnel

Off the coast of southwestern British Columbia runs the Strait of Georgia. Its waters reach depths of up to 250m, dividing the province's capital from the rest of the country. Considerable improvements to crossing conditions are required, with residents currently relying on the services of an aging ferry fleet to traverse the 24+ km divide. Aedifix Consulting has integrated time-tested bridge and tunnel engineering principles with off-shore platform technology to develop an innovative solution to spanning deep, expansive bodies of water: the Submerged Floating Tunnel.



ANUM MITHANI, MARCEL GAMON,
ZAFIRA REHMTULLA, DILAN BADSHAH



RYAN SCHULTZ, KURT WENINGER, ADAM TIMLOCK,
AGATA STARKIEWICZ



ERIKA KRUTSCH, MELISSA JENNINGS, LAURA LUNA,
ELISHUA BEN-CHOREEN

4 Bridges Unlimited Ltd. Goat Island Pedestrian Bridge Replacement

The pedestrian bridge that provides Niagara Falls, New York access to Goat Island is currently in a state of disrepair. A long term solution must be developed to maintain tourist access to the many beautiful vistas that Goat Island offers of the waterfalls. Bridges Unlimited Ltd has designed a solution in the form of a concrete deck arch bridge that incorporates glass decking and a central viewing platform for an enhanced tourist experience.

5 Phoenix Construction Ltd. Post-Disaster Modular Homes

Typical home designs and construction methods are not idealized for post disaster situations. What if homes can be fabricated, shipped in a standard shipping container and constructed on site in a matter of days? The answer lies in modular design, lean construction methods and optimized shipping.

6 Surbeck Consulting Ltd. Design of a permanent crossing between Kingston and Wolfe Island

Wolfe Island is located in Lake Ontario at the entrance to the Saint Lawrence River, offshore from Kingston, Ontario. Currently, Wolfe Island is only accessible by a ferry, owned by the Ministry of Transportation of Ontario. This ferry is over capacity year-round, particularly in the summer season. A bridge is proposed to replace the ferry service, providing a permanent access route to the island and eliminating traffic congestion. The project includes preliminary structural design, pavement and geometric road design, and stormwater management.



STEPHAN MATIOWSKY, PAUL CASSELL,
KYLE PELLERIN, MATTHEW TONELLO



THERON COETSEE, PRAVIR JEEHA,
OMAR HASSANEIN, SLOBODAN DJURDJEVIC



DAHLIA MALEK, TONY SHIH, JENNIFER NHU,
ANUSHA SHANMUGANANTHA

7 TALK Structural Ltd. Structural Design of Pamoja Ministries Operations Facility in Tanzania

The design of a new base of operations for Pamoja Ministries in Arusha, Tanzania involved the analysis and selection of construction materials, assessment of construction phasing plans, and the structural design of the four-story, irregularly shaped building in a seismically active zone. Beams, columns, two-way slabs, connections, and the foundation were designed as reinforced concrete, and were sized and analyzed iteratively. The facility was designed to be constructed over several years in vertical phases using local construction practices.

8 Sorellanza Consulting Foldable Bridge

The first 48 hours after a natural disaster is when the most number of lives can be saved. However, the destruction of infrastructure such as roads and bridges poses a serious barrier to accessing those in urgent need. Sorellanza Consulting aims to design a foldable, compact, and lightweight temporary bridge that can be easily installed to enable the transport of people and aid, in and out of post-disaster regions.

9 SMJ Partners Warden Transit Station Functional Improvements Design

Accessibility and efficient mobility for transit users encompass much of what good transit design strives to advance. Many existent transit infrastructures feature functional forms that present operational challenges. Warden Station on the Toronto transit system exemplifies many concepts of transit interchange functionality and challenges. Our group strives to refine concepts for improvements to Warden Station that reflect design principles for good accessibility and efficient mobility. With respect to multiple design parameters, we intend to explore many ideas to conceptualize innovative, efficient, and sustainable solutions.



LYNN PUDDICOMBE, TIMOTHY TEDFORD,
ANDREW ZANDBERGEN, KYLA RODGERS



JUKYUNG CHRISTIE JEONG, GRACE SUNG-JI LEE,
MARIANNE JOY JUAN BAUCAS, LUCY WANG



SAM AAYANI, MURTAZA BUKHARI, JUNSUN WEI

10 TBD Engineering Design of Express-Collector Train System between Kitchener-Waterloo and Toronto

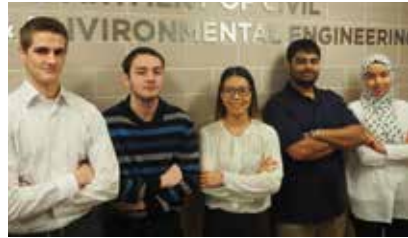
The transportation systems available between Kitchener-Waterloo and Toronto are limited, and lacking in user comfort. An evaluation of the state of the current systems, and a proposed improvement to the current systems, the Express-Collector Train, is provided. The Express-Collector Train does not stop between the start and end points, letting passengers off and on via a side-car which detaches from the main train. The design of the route, schedule, station, and track work required for this system to operate is the focus of this project.

11 SINC Engineering Ltd. Modular Parking Garage Design at Bay St/Lake Shore Blvd

An innovative modular parking structure that can be constructed and expanded in a fast and efficient manner has been developed by SINC Engineering Ltd. to accommodate the growing parking demands in downtown Toronto area. The nature of the design minimizes the social impact during construction while provides potential for future expansions. The design is not only limited to the GTA area, but also applicable to address parking issues in other places in Canada and around the world.

12 SDS Group Seismic Design Optimization for Residential Buildings in Santiago, Chile

After an 8.5 magnitude earthquake in Santiago, Chile, the collapse of hundreds of buildings has resulted in the need to construct new buildings, especially residential, that will withstand similar seismic effects from future earthquakes. Our project is to design a cost efficient six-storey residential complex using various seismic resisting structural elements and energy dissipating systems. The final design consists of an octagonal reinforced concrete frame and has been optimized using an iterative process between modeling/structural analysis (using SAP2000) and section design (using Python).



MARC JOHNSON, SEAN WATMAN, ERICA CHENG,
UMAIR NUMAN, SOLWAN ADEL ALDEEB



RUIZHI CHU, XIAO DING BU, DA WANG, KAN WANG



JACOB TIGGELOVEN, FREDRIC FONG,
NISSRINE BOUSLAMA, STANLEY CHENG

13 **Quadralink Engineering** **Integrated Bridge and Transit Station** **at the Steeles Avenue East &** **Stouffville GO Line Intersection**

Quadralink Engineering has designed a solution to an existing traffic congestion problem at the Steeles Avenue East & Stouffville GO line intersection. The solution includes an integrated bridge and transit station system which separates the grades of the arterial and the railway. The design features effective multi-use components as well as various functional components to maximize user comfort at the optimal cost. The integrated structure allows for maximum efficiency in design through sharing of structural components between both the bridge and the station.

14 **CMSS Consultants Inc.** **Curtain Wall Retrofit for Oakville** **Heights on Birch**

Occupants of a 25-year-old office building with a glass curtain wall have complained about issues such as water leakage, air leakage, condensation, heat transfer, solar heat gain, and visible transmittance in their building. CMSS consultants developed three alternative solutions to address these issues, and the optimal alternative was chosen for detailed design. The final product is applicable to glass curtain wall systems across southern Ontario and regions of similar climate.

15 **MAFT Engineering** **Lunar Foundation Design**

NASA has contracted MAFT Engineering to complete a geotechnical design for a foundation to be used for a storage facility, which will be one of the first permanent structures on the Moon. The ultimate goal is to create a settlement on the moon as a base of operations for future space exploration. And with the unique environment presented by the Moon, the design and construction must account for near zero atmosphere, lowered gravity, meteorite impacts and extreme temperature fluctuations.



DOMINIC CHO, DAN IANNETTE, DANIEL HAN,
RACHEL JUNG.



VICTORIA SPELLER, EDWARD MOORE, KALIE SMITH,
SAMANTHA COOKE



FARAZ MOHAMED, MATTHEW MALONEY, ALI RAZA

16 BEC Stress Ribbon Pedestrian Bridge with a Flowerpot Damping System

The upcoming ION transit is nearing completion in the Waterloo region which imposes a safety issue for crossing pedestrians at the Southern end of Waterloo Park. Bridge Engineering Consulting (BEC) is proposing to build a lightweight pedestrian bridge with a damping system over the rail track to mitigate this problem. The bridge will be a stress-ribbon bridge built with CFRP, which is a lightweight material. A mass of flowerpots will be developed and act as a damping system for both aesthetic and functional purposes.



EDEN LEE, HALEY CHUN, MICHELLE BUTT, BRENDAN KIM

17 SWAN Engineering Ltd. Solution to the Attawapiskat Housing Crisis

The Attawapiskat First Nations community in Northern Ontario has been continuously experiencing overcrowding in its existing homes unsuitable for the climate of the region. The purpose of this project is to deliver a sustainable solution for the housing crisis that incorporates scalability and customizability to meet the needs of individual families. This solution consists of a robust structural design of the circular shell structural inspired by a Mongolian yurt that is constructed using prefabricated modules which can be easily transported and assembled.



LYLA ROOS SMERCHINSKI, MENGCHEN XU, LILY YEXI ZHANG, XIAOYUN ZHANG

18 Palay Un Ltd. Mitigation of Typhoon Damages to Rice Crops in Central Luzon (Phase 2)

For Filipino farmers, rice is a staple food and a way of life. On average, Central Luzon in the Philippines is hit by nine typhoons per year. Each typhoon brings flooding and heavy winds that are more than capable of destroying an entire field of rice crops. We have designed a typhoon-resistant farm that will integrate with the Filipino culture to protect a portion of farmers' crops during and after each typhoon event.



ANSON CHEN, JOSEPH NG, ARTHUR LI, CHONG LUO

19 Vitaway VitaBridge

A bridge that promises not only to provide a safe crossing over the LRT rail lines and Ring Road, but also to advocate for climate change by using recycled materials as its aggregates. Using recycled glass and recycled concrete as fine and coarse aggregate, respectively, this bridge will highlight Waterloo's superiority in innovation.



DENIS BELOW, ANDRES VISUETTI VASQUEZ,
RUIJIE (NANCY) SUN, HASHEM HAMOUD

20 HyperLink Structural Tube Design of the Hyperloop Transportation System

The Hyperlink design team's goal is to design a tube structure that will allow for the travel of Hyperloop vehicles while sustaining sufficient vacuum pressure required for subsonic speed. The tube is also required to withstand the environmental forces experienced in the Southern California climate. The geometric and material configuration of the tube structure as well as the connection between the tube and supporting pylons are analyzed. Finite element methods are used and structural dynamics are investigated.



EARL FRANCIS MAGSIPOC, WANHUA (CAROL) LIANG,
LICHEN ZHANG, ANJIE LIU

21 VERSAJI Group Consulting Design Services for a Next Generation Neighbourhood Community

Global perspectives are changing towards sustainable and environmentally conscious construction processes. Our mission is to provide a subdivision that people would like to invest in and will serve as a precedent for future developments in Canada. We will apply engineering principles to innovate and exceed current subdivision standards. Important considerations include optimizing the design of buildings, providing new road networks, and incorporating low-impact development facilities. Finally, analysis software will be used to model energy usage.



SCOTT BUCKLEY, JACOB LECHOWICZ, IBAR AMIN,
ANTON VAN

22 KIWI Consulting Progressive Collapse Analysis and Retrofit Design

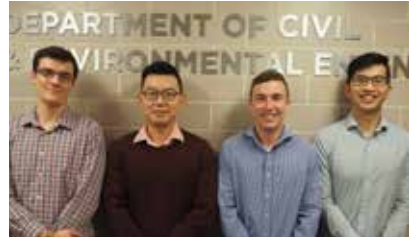
Progressive collapse occurs when a localized structural failure results in a disproportionate level of floor area collapse. KIWI has analyzed Engineering 5 for progressive collapse susceptibility and designed a retrofit to prevent a disproportionate collapse event. The retrofit was designed to retain the building's aesthetic and remain economically feasible.

23 EConnect Innovative Wildlife Crossing Solutions

Wildlife vehicle collisions account for approximately 50% of the total number of collisions along some stretches of highway in Northeastern Ontario. Due to urbanization and the expansion of road networks, wildlife vehicle collisions increase by an average of 9.5% per year. EConnect is dedicated to designing an innovative wildlife crossing consisting of a highway overpass and culvert to accommodate large mammals such as moose and deer as well as smaller wildlife. Our specialists will undertake a structural design, hydraulic design, and an environmental assessment.

24 Nidavellir Engineering Co. Underground Expansion of the Joseph Brant Museum

The Joseph Brant Museum, located in Burlington, Ontario, requires 15,000 sq.ft. of additional space to house new national exhibits. Nidavellir Engineering Co. designed a unique underground expansion below the existing museum that preserves the cultural significance of the original museum. The atrium-style expansion is crescent shaped, following the form of Joseph Brant's Mohawk military neck guard.



RONAN MULHERN, JUNMENG LIU,
GARY DAVID JOHN OGDEN, VINCENT W. CHU



MONICA MAZUR, ALEX ARDELEAN, LI CHENG



TERENCE MA, HAOLIN ROBERT ZHANG,
DARRYL BAKKER, ALEX CRESSMAN

25 DESIIGNERS Foundation Design for On-Shore Wind Turbines

At the dawn of a fossil-fuel free Canada, harvesting green energy is a priority. The wind energy sector has seen significant growth in recent years. Research indicates that wind turbines can output up to 20MW of power compared to the average capacity of 2-3MW. However, an increase in capacity would necessitate a considerable increase in size and a never-before-seen foundation capable of supporting such a structure. Therein lies the conundrum. DESIIGNERS seeks to push the boundaries of on-shore wind turbines by designing such a foundation.



JULIEN CHAPERON, SHIHAB SAADELDEEN,
JOHN BERO.

26 BN Consulting Ltd. Student Study Space Building (SSS)

The Student Study Space Building has been proposed by the University of Waterloo as a leisure, recreational and study space for students due to the increasing population at the school. BN Consulting Inc. has been selected as the lead consultants to carry out the design of the architectural, building envelope, and structural components of the building. The design of the building took into consideration the university's design objectives, as well as the student body's preferences in order to satisfy both stakeholders.



KOBIHAN KARUNAKARAN, HANI AGHA, WALID MASUD,
USAMA HAMID

27 Raft House Team Amphibious Housing Solution for Flood-risk Regions in Ontario

This project appertains to designing dynamic amphibious housing, consisting of flexible multi-layered systems, that will operate acquiescently in the midst of climatic influences and tides. Specifically, the objective of this project is to design a buoyant foundation in Brantford, Ontario, that is culturally sensitive, cost-effective, technically feasible, sustainable, and resilient against this low-lying city's high flooding potential. Moreover, the final design of this system aims to incorporate all necessary technical components with a view to achieving maximum efficiency and optimal performance while preserving aesthetic value.



ADNAN ABU ATIYA, RUMMAN RAHMAN,
YOUSSEF MOHAMED ZAKI, NIRBHAYPAL SINGH

28 MN2B Consulting Inc. Pedestrian Connection between Student Life Centre and Quantum Nano Centre at University of Waterloo

MN2B Consulting conducted a detailed design of an enclosed pedestrian overpass between the Student Life Centre and the Quantum Nano Centre at the University of Waterloo. The design consists of a steel frame with concrete slabs and other enclosure materials. The purpose of the overpass is to provide an indoor path between the Student Life Centre and the remainder of campus. The design objective is to provide a safe, economical, sustainable, design that is beneficial to the society, while providing an accessible, aesthetically pleasing and innovative structure.



BETHEL NEGASH, ARIANA BAKHTAR, SUPREET KAUR BOLA,
SENA MCCLEAN

29 Triton Engineering Retractable Tsunami Breakwater

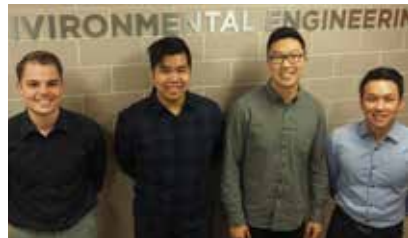
Triton Engineering has developed an alternative to traditional tsunami breakwaters. The Retractable Tsunami Breakwater (RTB) consists of moving segments stored in the seabed and can be deployed when required. The retraction system is fully automated and has no mechanical parts.



JOEL FERNANDES, VINEET ZACHARIA, PEDRAM YAZDAN
PANAH, HAMID MOHEBZADA, SHAWN WONG

30 S2JA Consulting Group Ltd. King & Victoria Transit Hub Transportation Infrastructure and Traffic Model

King and Victoria Transit Hub is a vital multimodal mobility hub connecting the Region of Waterloo's transit system to the overarching transit network of the Province of Ontario. The Transit Hub requires infrastructure for active transportation, Waterloo ION LRT, a new bus terminal, regional rail services such as VIA and GO, and upgrade of intersections and roadways to address the expected transit demands on the Region. S2JA Consulting Ltd has been retained by the Region to develop a solution to this complex transit infrastructure problem.



STEVEN BUCKLEY, ADRIAN CHIU, STEFAN TSANG,
JACKY CHAN

ENVIRONMENTAL AND GEOLOGICAL ENGINEERING

1 Brewery Wastewater Solutions Microbrewery Wastewater Treatment

Our project team has been retained by Innocente Brewery for the design of a wastewater treatment system for their microbrewery in Waterloo, Ontario. Short term objectives were focused on reducing surcharge fees from the City of Waterloo. This was done with simple, but effective process changes that can potentially save Innocente Brewery up to \$20,000 over the next 5 years. Long term objectives were focused on modelling and designing a full scale treatment system that would allow Innocente to plan for the future.

2 A₂J₂E Subsurface Drinking Water Disinfection: Minimizing Process Maintenance and Maximizing Public Health Protection

Implementing an alternative disinfectant more stable than chlorine has the potential to decrease the amount of resources spent in the operation and maintenance of the disinfection system. This study used surrogate bacteria and virus, E. Coli ATTCC 11229 and MS2 coliphage, to evaluate the efficacy of peracetic acid (PAA) for use in drinking water disinfection. The goal of this work was to evaluate PAA as an alternative disinfectant and design a treatment system for subsurface water as a drinking water source.

3 JANTECH Ltd. Remediation of an Urban Lake in Bengaluru, India

Jakkur Lake is a 200-year old man-made lake in one of India's largest cities, Bengaluru. It provides a multitude of ecological services to the local community. The water quality has been deteriorating due to raw sewage entering the lake, resulting in fish kills and algae blooms. JANTECH Ltd. has designed a treatment solution using nutrient assimilation processes found in nature in the form of a constructed wetland. This system will restore the lake's capacity for biodiversity, be self-sustaining, and have a low capital cost.



DAVID KLEINHANS, ALEX WERENKA, KAROL PAYA,
DANIEL KOETSIER



ANN GIBSON, AVALON OLESEN, JACQUELINE DAROCHA,
JENNIFER CHAN, ELYSE DICKSON



JANIS LOBO, ASEELA NAQVI, JOY LIU, NOORULAIN SALIM

4 **SpongeCity Corp.** **Innovative Stormwater Management in the City of Toronto, Exhibition Place (Team 1)**

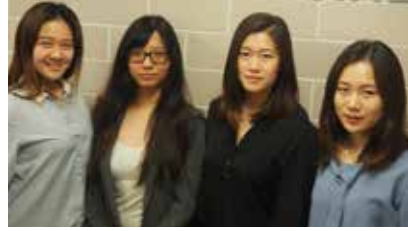
The Exhibition Place is facing a conundrum. The site has a significant number of asphalt parking lots, which are considered infrastructure deficits. During rainfall events, untreated runoff and external drainage received from the Gardiner Expressway accumulates and becomes contaminated, causing flooding and posing great threats to the surrounding ecosystem. In response, SpongeCity Corp. has developed an innovative solution following the Low Impact Development principles. The design can effectively manage stormwater quality and quantity, which preserves water balance and mitigates climate change impacts.

5 **E4 Consulting** **Innovative Stormwater Management in the City of Toronto, Exhibition Place (Team 2)**

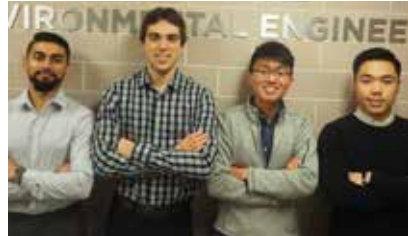
The inadequate stormwater collection system at Exhibition Place is responsible for downstream flooding of Lakeshore Boulevard and poor water quality in Lake Ontario during large storm events. As part of the Water Environment Association of Ontario's 2017 Student Design Competition, a preliminary design comprised of low impact development stormwater management retrofits is to be produced to satisfy key water quality, quantity, balance, and climate change objectives. An innovative conceptual design for managing external drainage from the Gardiner Expressway is also included in this project.

6 **MICC Group** **Naturalization of an Industrial Channel: Clearview Creek, Oakville, Ontario**

The MICC Group presents an industry first detailed naturalization design of an urbanized river channel using the latest two-dimensional hydraulic modelling software HECRAS 5.0 in partnership with GeoProcess Research Associates. The team has successfully optimized a design that provides in-channel stability within the strict confines of table land requirements that are now protected against a 100-year return interval storm event.



ZIWEI FAN, BITAO YAN, CHUNYING ZHAO, WEIYI ZHANG



JAY PATEL, PATRICK KING, ELLIOT PAI, RYAN LAW



PAUL CHIOCCIO, ARYN CAIN, IOLANDA MONTAGNESE,
MATTHEW IANNETTA

7 J-CAM Inc. **Rock Slope Stabilization and Monitoring Analysis and Design**

Recently, J-CAM has identified an at-risk rock outcrop that is a part of the Niagara Escarpment, located in the popular leisure destination of the Kelso Conservation area. As frequent rockfalls have been historically noted along this escarpment, it is J-CAM's desire to perform a rock slope stabilization analysis and design a long term monitoring program. This innovative design will be established through use of drone photogrammetry and Total Station surveying data, field and laboratory testing, factor of safety calculations, and 3D point cloud modelling.

8 Renegade Rock Experts **Toquepala Mine East Wall Slope Design**

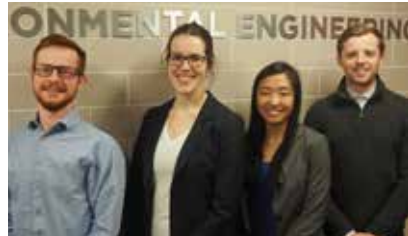
RRE was retained by Toquepala copper mine to design the ultimate slope of the mine's East Wall. At completion, the mine will span 1km across and 1.2km deep. Design and analysis was first undertaken using 2D finite element analysis and the Shear Strength Reduction method. Various alternatives, considering slope angles, stabilization measures, and groundwater conditions were evaluated. The recommended alternative, a 150m high breccia toe berm, designed using innovative 3D FEA software, has the potential to revolutionize slope stability design of open pit mines.

9 BBMM Foundations **A Subterranean Car Collection: Foundation Design for an Underground Garage**

Tolson Engineering Projects Ltd. has been tasked with the design of a three-storey deep underground garage in Caledon, ON. They have subcontracted the foundation design, construction plan and site dewatering to BBMM Foundations. Several site characteristics including a high water table, limited space, and a thick, soft clay layer will pose significant design challenges for BBMM Foundations. The ideal design is optimized based on cost, while meeting regulatory requirements. Additionally, it must be fully constructed without causing damage to the existing residence on-site.



JUNAID FAROOQ, CASEY VANDERWERFF, ANNA PASTEGA,
MICHAEL YANG



TREVOR WHITE, MICHELLE WESOLOWSKI, HELENA DIAO,
IAN GARDINER



ROBERT MURPHY, MARK BERTENS, JARRYD BUCK,
WESTON MORLOCK

10 NO3Solutions Design of a Near Real-time, In-situ Nitrate Monitoring System

Nitrate pollution has been recognized as a severe issue due to its detrimental effects to aquatic ecosystems and drinking water quality. Current methods to monitor nitrate levels are costly and are unable to capture the complex nature of nutrient transport. NO3Solutions has designed and built a nitrate monitoring device that is economically competitive and has the capability to capture nitrate concentration in real-time. Design parameters also include accuracy, precision, ease-of-use, portability and robustness.

11 TBOA Consulting Design of an Offshore Wind Farm in Lake Huron

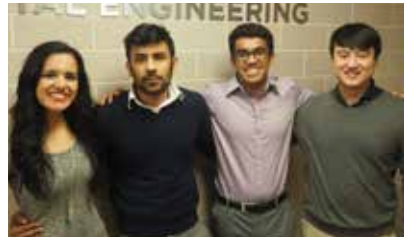
Over 150 metric tons of carbon dioxide equivalent is emitted annually from Ontario marking it as one of the largest greenhouse gas emitters in Canada. With growing concerns surrounding climate change Provincial Power Generation is looking for alternative renewable energy sources in an effort to reduce Ontario's dependence on natural gas for electricity. TBOA Consulting has presented a new and innovative solution by proposing the first offshore wind farm in Canada. Located in Lake Huron, this project encompasses foundation design stability and maximum energy generation.

12 BTC Ltd. Subarctic Tomatoes: Design of a Geothermal Greenhouse

Communities of Northern Canada face challenges in food production and supply as a consequence of location and access. Whitehorse is one such city that also holds significant pockets of untapped geothermal energy. Therefore, BTC is proposing the design of a commercial greenhouse operated by geothermal heat pumps as a way to remediate the issue. The aim is to develop a sustainable greenhouse that captures the Earth's thermal energy to enable year-round production of fresh, locally-sourced tomatoes at lower prices.



ALLAN LIU, MEGH SUTHAR, JIMI PATEL, STELLA JHANG



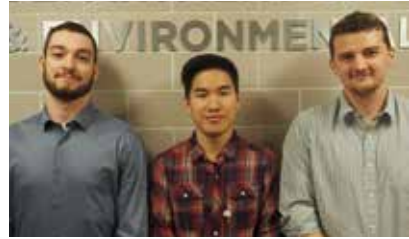
ROSHANI SHARMA, NAVEED ANIS, ERIC THARUMALINGAM,
NELSON JAI



SHRUTIKA SAINANI, YEN HUYNH, JAE WON (DANIEL) KIM,
WAYNE SUNGHYUN PARK

13 TriSpade Engineering Shallow TBM Bored Tunnel Support System for Highly Jointed and Fractured Limestone

The City of Montreal is looking to install a new water main under the streets of the city. TriSpade Engineering has been tasked with identifying the most geologically adverse sections of the proposed route and designing an innovative, cost effective means of supporting the TBM bored tunnel. Conjointly with design, TriSpade will be implementing a plan for the construction execution and sequencing for the duration of the project.



TRISTAN BRESOLIN, ANDUS MOK, CAMERON SWEETNAM

INTERDISCIPLINARY TEAMS

1 ShelterShield ShelterShield: Emergency and Natural Disaster Preparedness for Residents of Canada & the US

When disaster strikes, it is up to residents of Canada and the US to cope until help can arrive. In order to mitigate the impact of natural disasters and emergencies, ShelterShield is a webtool which provides a foundation for preparedness, based on user input. ShelterShield delivers preparedness information for disasters prevalent in the user's region, and optimizes preparedness kit items for their living conditions and budget. ShelterShield has been designed for the disaster relief organization ShelterBox, who intend to implement ShelterShield on their website.



JESSICA MACKINNON, CASSANDRA KAUER, IPSITA RANJAN,
DANA BAER

2 Enviro Sigma The Design of a Process to Upgrade Raw Biogas to Renewable Natural Gas for a Dairy Farm

Our aim is to design a process that upgrades raw biogas from a dairy farm to renewable natural gas. Raw biogas contains carbon dioxide and methane, and its energy content can be enhanced by converting the carbon dioxide to methane through methanation. The system will reduce greenhouse gas emissions, by capturing the methane in an anaerobic digester. Our project will produce an Aspen Plus simulation and an optimized energy system to support the upgrade process, as well as economic and environmental analyses of the design.

3 FYDP Cultivation of Algae Using Wastewater Treatment Plant By-Products

The objective of this project is to design a cost-effective system to cultivate algae using wastewater treatment plant by-products as feed materials. The design is such that it will be on-site of a wastewater treatment plant in a climate consistent with that of southern Ontario. The intention of this design is to reduce environmental impacts of wastewater treatment plants by utilizing carbon dioxide emissions and excess nutrients while creating a valuable product (in this case, algae for biofuel production).



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KATIE HEALEY, KATHRYN KERKER, DANYKA BYRNES

Future design projects

We are interested in future Capstone projects from industry. Find one of our Capstone Coordinators today to ask them about this:



DR. BRYAN TOLSON



DR. CHRIS BACHMANN

After the symposium, if you are looking for more information about civil, environmental and geological design projects or to inquire about joining us in future design projects, please contact:

Dr. Chris Bachmann

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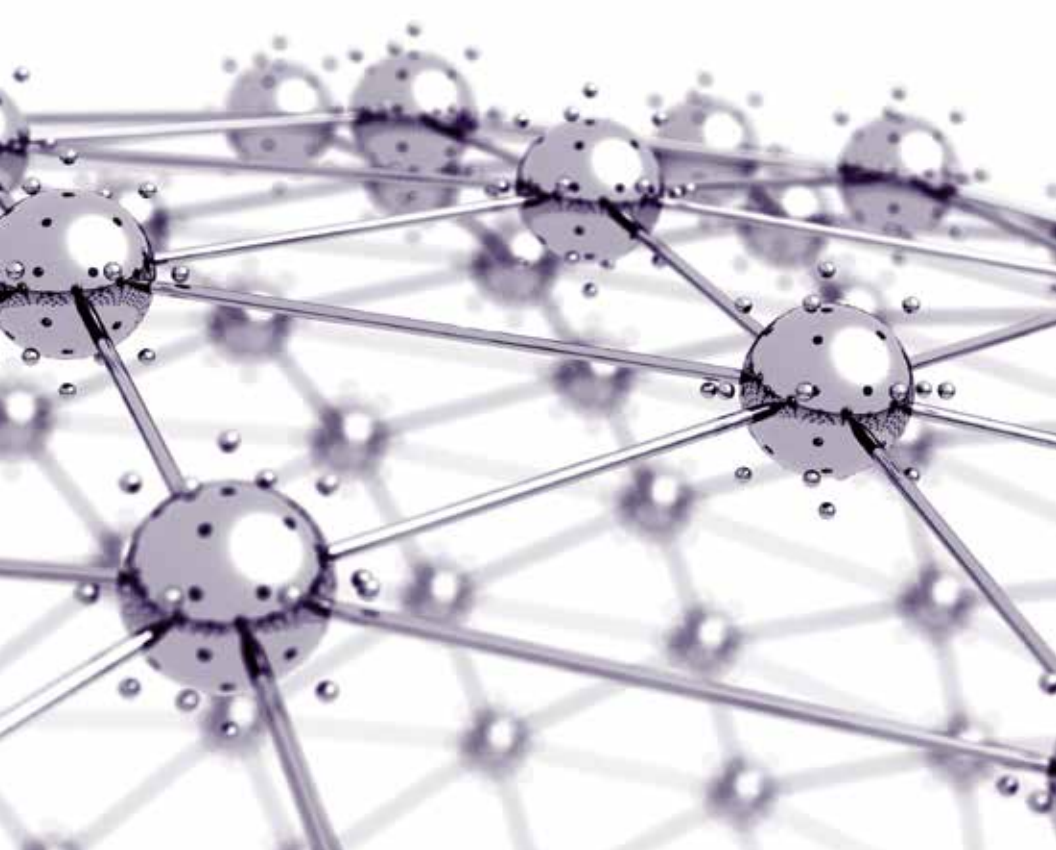
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Professional, Technical and Administrative Support Staff

Our sincere thanks go to all of our professional, technical and administrative staff that assist our students during the course of their design project experiences.



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