

Call for MASc or PhD Candidate in Civil Engineering:

Climate-Data-Driven Design of Low Carbon Concrete Structures

Location: Department of Civil Engineering, Lassonde School of Engineering, York University, Toronto, Canada

Anticipated Start Date: January 1st or May 1st, 2023

Application Deadline: September 26th, 2022

Funding: Fully-funded graduate fellowship

Principal Investigator: Prof. Liam Butler, P.Eng.

Research Areas: *Low carbon concrete materials; Climate Resilient Infrastructure; Infrastructure Sensing, Structural Engineering.*

Project Scope and Role Summary

The influence of climatic variations on Canada's vast infrastructure stock, valued at over \$850 billion, are largely ignored in infrastructure design. Variations in temperature, relative humidity, solar radiation, and precipitation, along with increased frequency of extreme events will lead to cyclic fatigue and other factors that influence the behaviour of infrastructure materials. In conjunction, innovative low carbon concrete materials are increasingly being explored as viable options for enhancing infrastructure sustainability. These new materials offer significantly reduced carbon footprints compared with conventional concrete; however, further research on their short and long-term performance is needed before they are adopted in practice.

Dr. Butler's research team has been developing novel forms of low carbon concrete (LCC) incorporating supplementary cementitious materials (i.e., fly ash or ground granulated blast furnace slag), locally-sourced recycled concrete aggregates (RCAs), and recycled plastic fibres. The use of these materials has several advantages as they can alleviate the burden placed on non-renewable aggregate resources; they can increase the service life and capacity of landfill sites; and can reduce equivalent CO₂ emissions and traffic congestion associated with the transport of natural materials from remote sites. Although a significant body of experimental works have confirmed the suitability of these materials for use in structural applications, very limited data is available on their in-situ and long-term durability performance under realistic climate conditions.

An exciting opportunity for an outstanding graduate researcher exists to make contributions within this increasingly important field of study. Based within the Department of Civil Engineering, and under the supervision of Prof. Liam Butler, the graduate researcher will embark on a unique experimental research program utilizing the newly established *Climate-Data-Driven Design (CD3) Facility for Built Infrastructure* at York University. This innovative facility will enable research in the development and long-term testing of various LCC materials, under real environmental conditions, using advanced structural sensing, climate measurements, and machine learning techniques. Applications for one graduate researcher position in structural and materials engineering are currently being sought at the MASc level. However, outstanding candidates with the required qualifications will be considered for entry into the PhD program.

Candidate Profile

MASc applicants must have an undergraduate (Bachelor) degree in **Civil/Structural Engineering** or a closely related engineering discipline by the project start date. PhD applicants must have both an undergraduate (Bachelor) degree and a Master's degree (thesis- or research-based) in **Civil/Structural Engineering** or a closely related engineering discipline. Applicants to the PhD program are also expected to have a significant publication record within top-tier engineering journals. All candidates must demonstrate a broad knowledge and passion for structural engineering, sustainable concrete materials, climate-resilient design, and infrastructure sensing. As this project is highly interdisciplinary and involves working in diverse research groups, candidates should possess excellent communication and writing skills, including the ability to communicate complex technical knowledge effectively with a wide range of stakeholders. Candidates should also demonstrate an appreciation for the required effort and the enthusiasm to successfully complete an MASc or PhD degree.

Application Instructions

Any questions about this position should be directed to Prof. Liam Butler (Liam.Butler@lassonde.yorku.ca). Interested applicants should email a **cover letter, a one-page research statement**, their current **curriculum vitae**, and **transcript(s)** (official/unofficial) to Prof. Liam Butler (Liam.Butler@lassonde.yorku.ca) by September 26th, 2022. Cover letters should clearly indicate whether the application is being submitted at the MASc or PhD level. Applications will be reviewed, and shortlisted candidates will be invited for a virtual interview. All prospective MASc or PhD students must meet the respective program requirements as outlined by the Department of Civil Engineering. The selected candidate will then be invited to submit their official application through the Faculty of Graduate Studies (<https://futurestudents.yorku.ca/graduate/apply-now/>).

Funding Support and Benefits

This position includes a competitive funding and student benefits package to help meet the financial needs of a typical graduate student. The funding model is comprised of a fellowship amount and salary amounts from working as a Teaching Assistant and Research Assistant. Additional information regarding funding can be found here: <https://civil.lassonde.yorku.ca/graduate-funding/>.

Graduate Studies in Civil Engineering

The Graduate Program in Civil Engineering offers advanced training leading to Master of Applied Science (MASc) and Doctor of Philosophy (PhD) degrees. Three main research themes distinguish the program: infrastructure, resilience, and sustainability through the established sub-disciplines of Environmental and Geo-Environmental, Geotechnical, Structures, Transportation, and Water Resources Engineering.

Cutting-edge research is being carried out in our state-of-the-art facilities, which are located in the Bergeron Centre for Engineering Excellence and across the Keele Campus. The facilities include 750m² of dedicated laboratory space, including the Structures High-Bay Laboratory, the newly established Climate-Data-Driven Design (CD3) Facility for Built Infrastructure, and

additional research laboratories and computational facilities for Geo-Environmental, Geotechnical, Construction Materials, Transportation and Water Resources sub-disciplines.

Our state-of the-art facilities will allow graduate students to conduct research on above-ground and buried infrastructure; on the performance of civil infrastructure during extreme loading events, including the influence of climate change; on the development of novel materials and construction technologies that improve the resilience of civil infrastructure; on innovative site remediation technologies; on development of technologies for construction using recycled and renewable materials; on construction over marginal-quality land and degrading permafrost; on smart wastewater and material recovery technologies; and on advanced transportation research including transportation safety, security, and intelligent transportation systems. Additional information about the graduate program in civil engineering is available here: <https://lassonde.yorku.ca/academics/graduate-program-in-civil-engineering>

York University and Toronto

York University was founded in 1959 and has now planted its flag at three central campuses: Glendon, Keele and Markham Centre. York also has two locations in downtown Toronto: the Miles S. Nadal Centre and the Osgoode Professional Development Centre, as well as international locations in India and Costa Rica. The third largest university in Canada, York is a positive force for change as a leading teaching and research university. The student body is both large and diverse with over 53,000 students from 178 countries walking through its halls with over 1,400 full-time faculty members and librarians.

Research at York is strongly engaged internationally and has significant global impact. Indeed, over the past five years, 55% of York publications resulting from the collaboration of two or more authors have at least one author from outside of Canada. This leads all Ontario universities. York is currently ranked 33rd globally in the Times Higher Education Impact Rankings.

York scholars have achieved the highest recognition in their fields. They include over eighty Royal Society Fellows and twenty-five Distinguished Research Professors. They have been inducted as members of the College of New Scholars, Artists and Scientists and named Killam Professors, Humboldt Fellows, Fulbright Scholars, and Trudeau Foundation Fellows. They have been recognized as Steacie Medalists and Governor General's Award winners and receive a range of disciplinary honorifics and prizes for their books, lectures, and other scholarly achievements. York's allocation of thirty-five Canada Research Chairs is complemented by over thirty York Research Chairs and over thirty-five named Chairs and Professorships.

York University's Keele Campus is located in Toronto, Canada. Toronto is Canada's largest city and the capital of the Province of Ontario. While the city, which is on the north shore of Lake Ontario, has a population of approximately 2.9 million, the surrounding metropolitan area, the Greater Toronto Area (GTA), reaches upwards of 6 million. Toronto is distinctly multicultural, with an estimated 50% of the population being born outside of Canada. This has in turn made the city 'a city of neighbourhoods' because it is composed of many distinct, smaller areas with unique cultures.