

## Call for MASc and PhD Candidates in Civil Engineering:

# Developing 3D-Printed Low Carbon Concrete for Use in Residential Construction

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

**Number of positions:** Two (1 MASc and 1 PhD)

**Start Date:** September 1<sup>st</sup>, 2024, or January 1<sup>st</sup>, 2025.

**Application Deadline:** July 2<sup>nd</sup>, 2024

**Funding:** Fully funded fellowship with additional project top-up amount

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

**Research Areas:** *Low carbon concrete; Additive manufacturing; Infrastructure Sensing, Affordable housing construction; Structural Engineering.*

## Project Scope and Role Summary

In Canada, the construction sector faces significant challenges including a skilled labour shortage, upholding the highest standards of safety, improving the quality and affordability of new residential housing, and lowering the overall carbon footprint of our built environment. Concurrently, emerging technologies in additively manufactured concrete structures are quickly gaining momentum throughout global markets and can provide a viable solution to directly address our construction sector challenges. This research project will develop new low carbon 3D-printed concrete (3DPC) mixtures, structurally efficient 3DPC columns, and provide much needed data on how these emergent materials perform under long-term realistic climatic conditions. The anticipated outcomes resulting from this research will be critical enablers for adoption of 3DPC in new residential construction.

An exciting opportunity exists for two outstanding graduate researchers (one at the MASc and one at the PhD level) to make contributions within this emerging field of study. Based within the Department of Civil Engineering and working with the *Sustainable Concrete Structures Group* under the supervision of Prof. Liam Butler, the graduate researchers will embark on a unique experimental research program working with our industrial partners, Printerra Inc. utilizing full-scale 3DCP construction equipment, the novel *Climate-Data-Driven Design (CD3) Facility for Built Infrastructure and the state-of-the-art High Bay Structures Laboratory* at York University. These innovative facilities will enable research in the development and long-term testing of various low carbon 3DPC materials and components, under real environmental conditions, using distributed fibre optic sensing, climate measurements, and advanced data analytics.

## 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. Previous experience in concrete materials research is highly desirable.

**PhD applicants:** must have both an undergraduate (Bachelor) degree and a Master's degree (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. Previous experience in concrete materials research is required.

Preference will be given to those candidates from historically marginalized groups. Candidates with previous experience related to 3DCP materials are especially encouraged to apply. All candidates must demonstrate a broad knowledge and passion for structural engineering, sustainable concrete materials, additive manufacturing, climate-resilient design, and infrastructure sensing. As this project is highly interdisciplinary and involves working with industry partners and 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](mailto: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. Butler ([Liam.Butler@lassonde.yorku.ca](mailto:Liam.Butler@lassonde.yorku.ca)). Cover letters should clearly indicate whether the application is being submitted at the MASc or PhD level. **Applications are due on July 2<sup>nd</sup>, 2024.** 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 highly competitive funding and student benefits package to help meet the financial needs of a typical graduate student living in Toronto. The funding model is comprised of a fellowship, project top-up, 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, Structural, 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 750m<sup>2</sup> 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 40<sup>th</sup> 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 neighborhoods' because it is composed of many distinct, smaller areas with unique cultures.