

ONTARIO UNIVERSITIES: BUILDING ONTARIO'S INFRASTRUCTURE

The Issue: Investments in Ontario's infrastructure will continue to be critical as the province's population is expected to grow by as much as six million by 2043. Designing, building and upgrading the infrastructure our province needs to provide reliable and sustainable services, house Ontarians and get people where they need to go will be key to strengthening communities across the province.

Ontario's universities are helping drive the province's infrastructure by training the highly skilled talent needed to build new construction and maintain existing infrastructure, as well as leading innovative construction and urbanization research for a thriving economy.



Background

- Ontario faces an infrastructure State of Good Repair backlog of \$52 billion, according to a 2021 report from the Financial Accountability Office of Ontario. Addressing this backlog is central to supporting and building strong, safe and healthy communities across the province.

By 2030, Ontario's labour market will require more than 233,000 university-educated workers in STEM, including close to 35,000 in construction and infrastructure-related fields and nearly 7,000 architects and land-use planners, according to projections from Stokes Economics.

- Ontario must act to provide the robust infrastructure needed to support our growing population. With the population of the Greater Golden Horseshoe projected to grow from 10 million to 14.9 million by 2051, building new transit projects and highways that will meet the needs of Ontarians for decades to come will be critical.

How Universities are Supporting Ontario

Engineers, architects and urban planners are just some of the many skilled professionals Ontario will need to design and develop new infrastructure, as well as plan and manage new construction projects. Universities are training highly skilled talent in these fields and providing them with work-integrated learning opportunities to ensure that they graduate job-ready.

At the same time, universities are delivering ground-breaking innovations in construction and modular housing, such as high-efficiency building practices and the use of mass timber in large-scale development projects that will help reduce the environmental impacts of new construction and support Ontario's timber industry.

As Ontario continues to invest in major transit, highway, housing and other infrastructure projects across the province, the research undertaken by university researchers can help enhance the lifespan of these critical assets.

By partnering with provincial and municipal governments, universities are contributing to the longevity of these assets by developing new technologies and approaches to monitoring the performance and integrity of Ontario's infrastructure.

Ontario's universities have increased enrolment in engineering and applied sciences programs by 66% from 2010-11 to 2022-23, according to COU enrolment data.

Partnering to Build a Stronger Ontario

A vibrant and healthy university sector is critical to meeting the needs of students, fostering community economic growth, driving research and innovation and developing the highly skilled talent critical to Ontario's economy.

It is why, in order to fully unleash their potential, Ontario's universities are asking for support – to allow greater flexibility to increase their revenue sources.

By working together, we can ensure the long-term financial sustainability of Ontario's universities and help the province address urgent workforce needs and assist in protecting the health and well-being of all Ontarians.



HELPING ONTARIO BUILD BETTER INFRASTRUCTURE



As Ontario invests in critical infrastructure and builds more schools, hospitals, highways and transit, the province will need highly skilled, career-ready STEM talent, such as engineers and architects, as well as innovative solutions in building design and materials that can withstand the impacts of climate change.

Below are just some of the many ways universities across the province are partnering with industry and local communities to train highly skilled talent, and to design, build and retrofit the infrastructure of the future.



● Leading ground-breaking research by driving innovation

● Invasive species present a significant risk to the timber industry – one of Ontario's main economic drivers – by harming local ecosystems that could threaten Ontario's ability to supply materials. **Algoma University** is leading critical research in invasive species biology by studying the effects of climate change on migratory and behavioural patterns, helping develop tools to safeguard the timber industry.

● As more municipalities look to mass timber as a low-carbon alternative to existing building materials, finding innovative solutions to managing potential fires is critical. Researchers at **Lakehead University** are partnering with lead mass timber manufacturers and industry experts to develop innovative structural systems for mass timber buildings to meet the fire resistance requirements of applicable design codes and standards.

● New construction is costly, especially when it comes to developing larger-scale buildings, owing in part to the costs associated with meeting codes for a strong foundational structure. Professor Lydell Wiebe at **McMaster University** is partnering to tackle this challenge through economical design, which minimizes foundation costs while maintaining high safety standards.

● As Ontario Power Generation (OPG) prepares to decommission its nuclear power plant in Pickering over the next decade, ensuring the process is safe for both the environment and communities is critical. **Ontario Tech University** researchers are partnering with OPG and RMUS Canada to test "Spot" – a four-legged robot – that will help bolster the safety of the nuclear maintenance program at OPG.

● To help address the challenges facing today's cities, the Research Centre on the Future of Cities at the **University of Ottawa** is exploring the relationship between the transformation of cities, the climate and social crisis, and the link between accelerated urbanization and the climate crisis, known as the Anthropocene. This research will have far-reaching implications in helping cities develop strategies and adapt to a changing climate and rapid urbanization.

● As the effects of climate change, such as tornadoes, continue to be felt across the province, researchers at **Western University** are helping develop new guidelines to the on-site construction of wood-framed roofs – known as stick-framing – which are currently vulnerable to high winds. These new guidelines will help ensure houses built with stick-framing are structurally sound and resilient against high wind speeds.

● Designing sustainable solutions to prepare for future impact of climate change

● To help meet Canada's climate goals and support sustainable infrastructure, researchers at the Centre for Advanced Building Envelope Research at **Carleton University** are partnering to develop new technical solutions that will help cut heat loss in buildings and reduce costs associated with energy retrofit construction.

● To deepen understanding of how urbanization and climate change are impacting plants, researchers at **Nipissing University** participated in a landmark global study that examined the evolution of white clover plants in 26 counties. The study concluded that the clover produced a specific chemical marker when it was further away from an urban centre – providing insight into how urban environments can be designed to support the natural environment.

● As municipalities adopt sustainable transit solutions, **OCAD University** partnered with the Canadian Urban Transit Research and Innovation Consortium to study Canada's capacity for wide-spread adoption of zero-emission busses. The research also explored key requirements and strategies for adopting sustainable transit, such as the power grid and local infrastructure needed to support the transition to clean energy and a green economy.



● Concrete accounts for almost 10 per cent of global carbon-dioxide emissions. Researchers at **Queen's University**, in collaboration with the University of Toronto and the University of Cambridge and industry partners, are researching strategies to reduce the emissions associated with concrete infrastructure. These strategies have the potential of cutting concrete carbon-dioxide emissions by as much as 50 per cent.

● To identify strategies that will lower the environmental footprint by reimagining how new infrastructure is designed, the Centre for the Sustainable Built Environment brings together seven researchers from across **University of Toronto**, as well as a dozen companies in construction and related industries. By working closely with this core industry group, the centre aims to speed up knowledge translation, ensuring that the insights gained through their research can be applied in industry.



● Ice roads play a crucial role in the remote community of Déli nē, Northwest Territories. In collaboration with Homa Kheyrollah Pour, a Canada Research Chair in Remote Sensing of Environmental Change at **Wilfrid Laurier University**, the community has been incorporating new technology to enhance safety and efficiency in building these essential ice roads that can make their work safer and more efficient. The team employs ground-penetrating radar on snowmobiles, drones, and satellite observations to measure real-time ice thickness on Great Bear Lake, identifying cracks and buckles crucial for determining optimal ice road routes for the long-term safety and well-being for northern communities.

● Building strong communities to create cost-effective and environmentally sustainable housing

● Women and gender-diverse people are disproportionately locked out of the affordable housing system. To better understand the barriers they face, **Brock University** partnered with the YWCA Niagara Region and explored actionable solutions that the federal, provincial and regional governments can take to help vulnerable women and gender-diverse people access housing, programming and supports.

● As the “digital divide” between those with and without sufficient access to technology, digital telecommunications and broadband services persists, better and more affordable broadband services are needed to address the issue. Through the Regional and Rural Broadband (R2B2), Dr. Helen Hambly at the **University of Guelph** is looking to close this gap and connect communities across Canada through partnerships and extensive research efforts in rural connectivity.

● Many northern communities rely on seasonal ice roads for food security, but the sustainability of these roads is at risk with climate change causing shorter ice seasons and thinner ice. To provide up-to-date information on ice road conditions and safety for drivers, researchers at the **University of Waterloo** developed an algorithm that can process satellite data and gauge the thickness of river ice.

● To help increase the availability of affordable housing in the local community, engineering researchers at the **University of Windsor** partnered with Habitat for Humanity Windsor-Essex to explore 3D printed housing. 3D printed housing could provide residents with cost-effective and environmentally sustainable housing that also meets residential building code requirements.

● Developing highly skilled talent to meet the future needs of Ontarians

● With a focus on design, culture, technology and professional practice, **Laurentian University** is helping its architecture students develop the skills and experience they need to design buildings and spaces that meet the unique needs of northern Ontario. Through the McEwen School of Architecture, students gain valuable hands-on experience in the community, as well as have access to the latest technology to support design fabrication.

● Through the Navigable Virtual Reality for Architectural Interactive Learning (NVR-FAIL) tool, a professor at **Toronto Metropolitan University (TMU)** is providing architecture students with the ability to navigate their architectural designs in a 3D space and experience their projects through a new perspective. This experiential learning is helping push the boundaries of forward-thinking architecture.

● Through community-based research, the Community Research Centre at **Trent University** provides students with the opportunity to gain work-integrated learning experience by working with local municipalities, social service agencies, conservation authorities and community interest groups to help guide community projects. Many projects explore critical infrastructure solutions concerning watersheds, housing and greenhouses.

● Responding to Environment and Climate Change Canada's emissions reduction projections, **York University** has signed an MOU with Noventa Energy Partners to use thermal energy from wastewater, including showers, dishwashers and hot tubs, to sustainably heat and cool Glendon campus. This partnership aims to enhance sustainability for the community, and there is a potential opportunity to pave the way for decarbonization of the campus.