CONSTRUCTION INNOVATION CENTRE
Research Driving Change

ANNUAL REPORT 2025

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INTRODUCTION

WHAT IS THE CIC?

The University of Alberta's Faculty of Engineering established the Construction Innovation Centre (CIC) in May of 2019. Its mission is "to provide breakthrough research, education and training that directly benefit Canada's construction industry and lead to the sustainable and economic development of our built environment and a competitive advantage for the Canadian construction industry."

The CIC brings together more than 30 established faculty members in construction engineering, building science, masonry, steel and water by uniting under one umbrella the Hole School of Construction Engineering, Nasseri School of Building Science and Engineering, Masonry Group, and Steel Centre. The CIC is supported by more than 50 partners in industry, professional associations, and funding bodies.

With the help of its partners, the CIC seeks to identify strategic directions for innovation and education and provide the united platform required to coordinate the activities and resources of the wide range of University of Alberta research groups in a manner that maximizes impact for the construction industry, Albertans, and Canada as a whole.

The CIC seeks to become an internationally recognized center for research, teaching, and training in engineering, construction, and servicing the built environment—the focal point around which academia, industry and government can come together to meet the grand challenges facing construction industries and create high-impact innovations across the construction engineering spectrum. We believe in research and innovation that drives change.

CIC Goals

- Accelerate and support **innovation**, **productivity**, and **competitiveness** in Alberta's and Canada's construction industry, including off-site industries materially impacting construction, through **high-impact research projects**
- Identify **industry needs** and align CIC research programs to meet these needs
- Provide a unified platform for **solutions to construction industry problems** through multi-disciplinary research
- Train the **next generation** of construction engineers and workforce with leading-edge knowledge and skills
- Enhance engagement with all stakeholders including government to **grow and sustain investment in Canada's construction industry**

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The CIC aims to provide breakthrough research, education and training that directly benefit Canada's construction industry and lead to the sustainable and economic development of our built environment and a competitive advantage for the Canadian construction industry.

ONGOING RESEARCH

CIC RESEARCH PROJECTS

Ongoing Research Projects (NSERC/MITACS Approved)

01 A Robust and Low-cost Technology for Risk Mitigation of Pathogenic Infection in HVAC Systems

02 Artificial Intelligence (AI) Powered Design and Manufacturing for Prefabricated Wood Buildings

03 BIM-Integrated Robotics for Intelligent Mass Timber Manufacturing and Operations

04 Construction-oriented Digital Twins for Multi-dimensional Production Planning and Control

05 Enhanced Perception for Autonomous Truck Mounted Attenuator (ATMA) to Increase Work Zone Safety

06 Enhancing Safety Management Systems on Construction Projects: A Data-driven Approach

07 Evaluation of Impact of Exoskeletons on Performance and Safety of Construction Workers

08 Federated Platform for Construction Simulation

09 Industrialization and Decarbonization of the Construction Process

10 Robotic wall construction using innovative building blocks and processes for enhanced productivity, safety, and sustainability

11 Practical Methods for Accurate Estimation of Overall R-Values of Masonry Walls

12 Structural Steel Project Development Integrating Structural Design and Construction Engineering: Quantitative Methods and AI-based Tools

13 A Computer Vision-Based, User-Centric, and Integrated Decision Support System for Construction Project Management

14 AI-Driven Solutions for Workplace Safety, Hazard Assessment, Material Management in Prefabricated Construction

15 Towards Carbon-Neutral Steel Buildings for Sustainable System Selection in Commercial and Residential Construction

NEW PROJECTS

CIC RESEARCH PROJECTS

CIC-approved Projects

01 An Open Platform for Predicting Energy Performance of Buildings: Accelerating Energy Code Adoption

02 Automated Work Planning Method for Self-Healing and Optimal Construction Schedules

03 Defining the Employability Attributes and Required Job Readiness Skills for Graduates of Construction Engineering Management

04 Driving Change Toward a Wider Adoption of Collaborative Delivery Methods in Canada

05 EEG-based Cognitive Monitoring Framework to Prevent Operators Cognitive Failure for Construction Safety and Productivity

06 Extended Reality and Optimization for Constructability Improvement in Industrial Construction

07 Fast and Flexible Manufacturing of Industrial-Size Components Using Weld-Based Additive Manufacturing

08 Performance-targeted Hybrid Multistory Buildings for Resilient and Sustainable Construction

09 Evidence-Based Assessment of Virtual Power Plants in Canada Powered by Residential Distributed Renewable Energy

10 Performance-Targeted Hybrid Multistory Buildings for Resilient and Sustainable Construction

11 Serious Incidents and Fatalities (SIFs): Enhancing Safety Management Systems through Integrated Data

12 Enhancing Productivity in Manual Off-Site Construction Operations Using Computer Vision and Data Analytics

13 BIM-Integrated Multi-Robot Platform for Customized and Sustainable Off-Site Construction Manufacturing

14 Carbon Neutral Construction Materials for a Circular Economy: Durable Geopolymer Units for Sustainability and Thermal Efficiency

15 Automated Proactive Safety Hazard Detection and Control

BY THE NUMBERS

PROJECT STATS

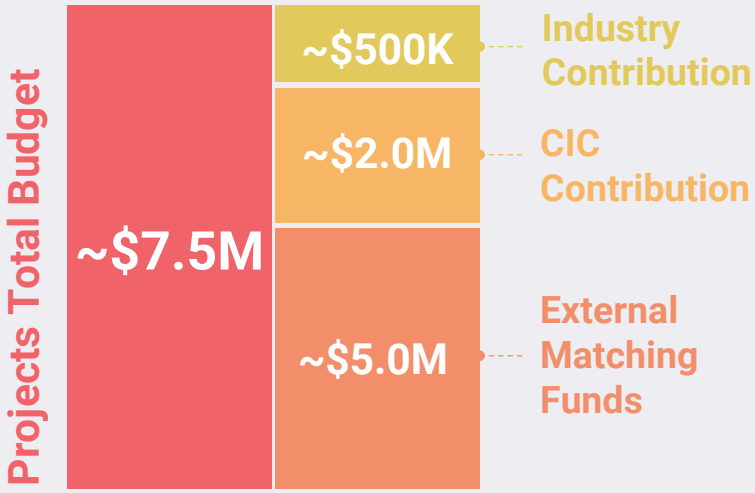
28
APPROVED PROJECTS

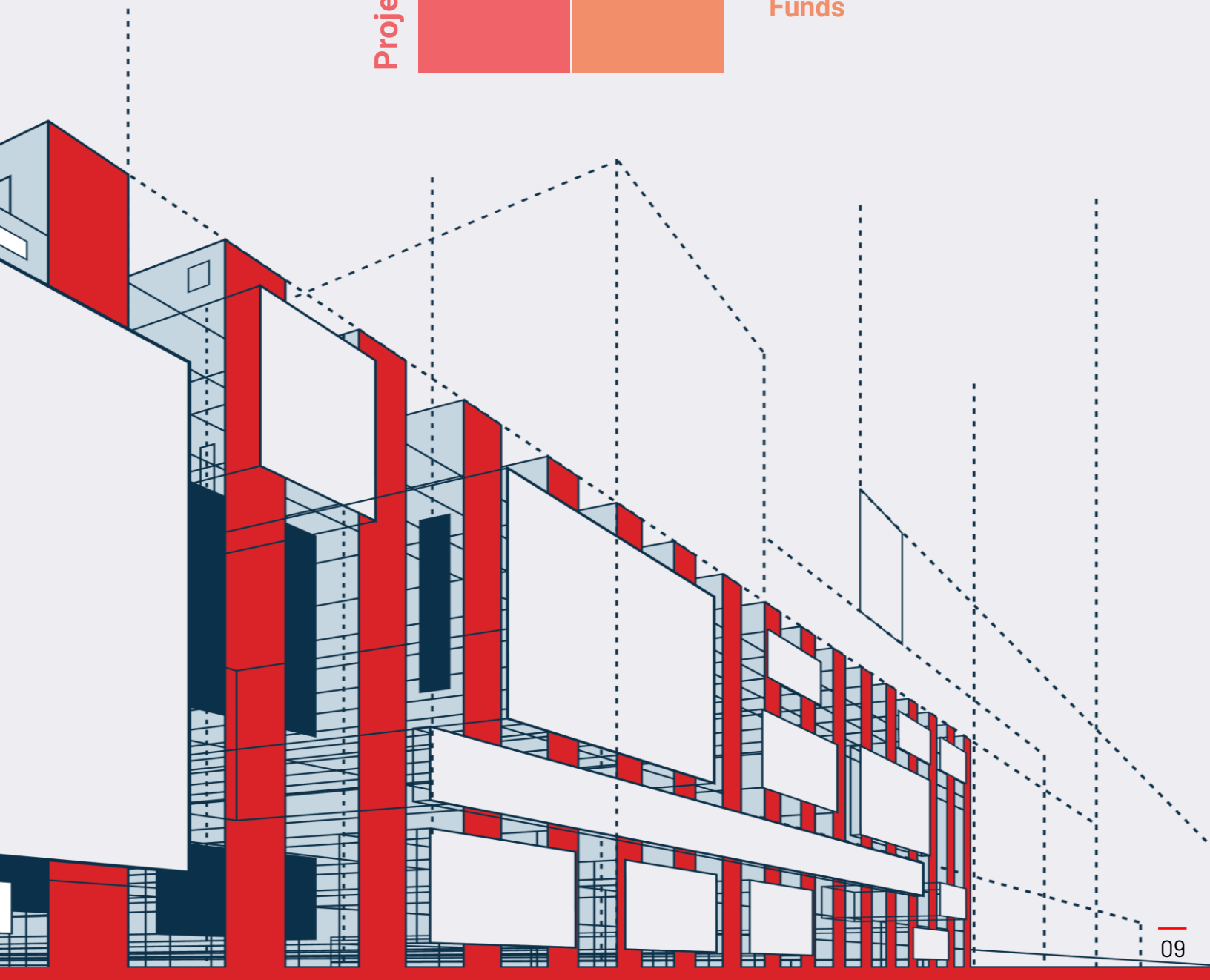
52
ACADEMIC RESEARCHERS

65
INDUSTRY PARTNERS

BY THE NUMBERS

PROJECT STATS





INITIATIVES

Updated CIC Research Roadmap

To ensure the CIC is meeting its mandate of providing breakthrough research that will have the greatest positive impact on the construction industry, the CIC has developed a revised research roadmap and strategic business plan. In the research, development, and refinement stages of this project, we engaged with more than 70 representatives from industry, academia, and government, to ensure our research priorities and implementation strategies were shaped by diverse perspectives from the many communities involved in construction innovation.

Research Priorities

Short-Term

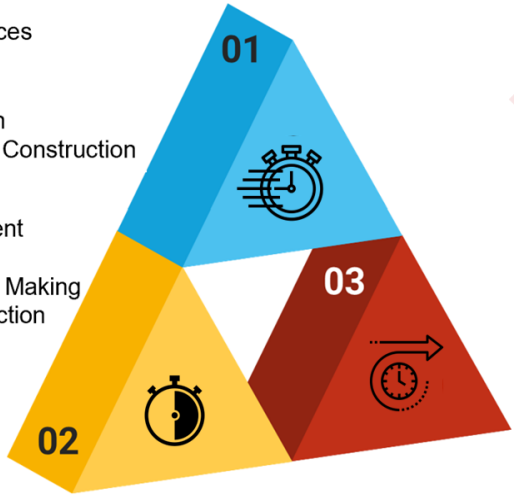
1. Workforce Development and Management
2. Advanced Construction Materials and Applications
3. Health, Safety, and Risk Management
4. Energy-Efficient Systems and Construction Practices
5. Construction Supply Chain Optimization
6. Lean Construction and Manufacturing
7. Automated and Generative Design in Construction
8. Smart Procurement and Contract Management in Construction

Mid-Term

1. Sustainable and Net-Zero Construction Management
2. Digital Transformation in Construction
3. Performance Monitoring and Data-Driven Decision Making
4. Climate Adaptation and Disaster-Resilient Construction

Long-Term

1. Advanced Construction Technologies
2. Policy and Regulation in Construction
3. Decarbonization of Construction Processes



INITIATIVES

Updated CIC Research Roadmap

Building Blocks for Implementation

establishing long-term, flexible objectives based on emerging technologies and threats, while maintaining adaptability as a core principle.

- **Research**: regular engagement with stakeholders to ensure research priorities and activities meet the most pressing challenges and opportunities
- **Service**: tangible support, from proposal development to prototyping facilities and commercialization pathways, to shrink the gap between innovation and implementation
- **Measure**: providing transparency and accountability, and using performance indicators and stakeholder feedback loops to stay aligned with objectives
- **Demonstrate**: testing and showcasing innovations in real-world settings
- **Collaborate**: formal partnerships between academia, industry, and government to reduce fragmentation and foster co-development of solutions
- **Finance**: promoting diversified funding models that combine public support, industry contributions, and commercialization revenues to ensure the CIC's long-term sustainability

Research Impact

All CIC project proposals, regardless of which theme the project falls under, will be evaluated against six key indicators of industry impact:

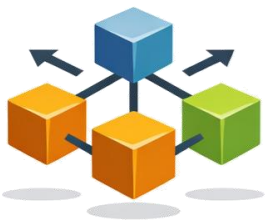
Productivity Improvement

Cost Efficiency & Value

Waste & Resource Reduction

Workforce Capacity & Skills Development

Safety, Risk Reduction & Well-Being



Scalability & Replicability

INITIATIVES

CIC Studentships

Building on last year's success, the CIC continued to offer studentship opportunities to its members. Studentships are an internship position providing members with access to talented students are fully paid by the CIC. In 2025, fourteen studentships (more than double the number offered last year) were completed by graduate and undergraduate students from the Department of Civil and Environmental Engineering as well as the Computing Science Department. The CIC will continue to provide studentships during the 2026 Spring and Summer semesters.

> *It was a great opportunity for both Student and Employer. We look forward to many more Studentships in the future.*

> *The CIC studentships are a valuable way to progress our portfolio of emerging technology and approaches to a traditional industry, and both our students and ourselves learned a lot through the process.*

> *We had the opportunity to work with a student from the CIC Studentship, and he brought valuable insights and current academic knowledge to our data analysis approach. A great experience with the CIC program!*

EVENTS

CIC Forum 2025

The CIC annual FORUM provides a platform to share the most recent advancements in construction innovation and to form collaborations among innovators, researchers, and construction professionals. This year's program emphasized the relationships between innovation, collaboration, and implementation, as attendees participated in networking, panel discussions, and roundtables.

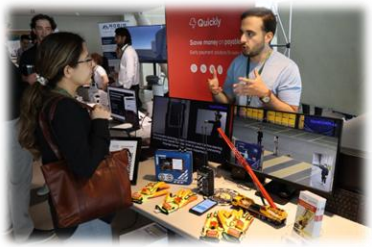
Sessions also included presentations on labour trends, innovation in SMEs, and how both startups and researchers are tackling real-world industry challenges.









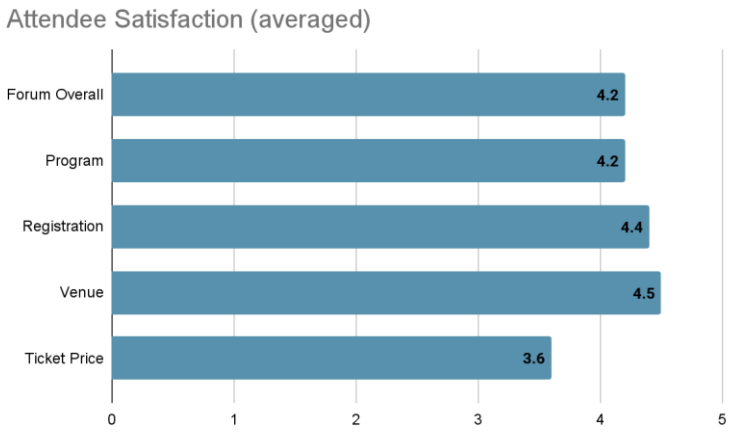


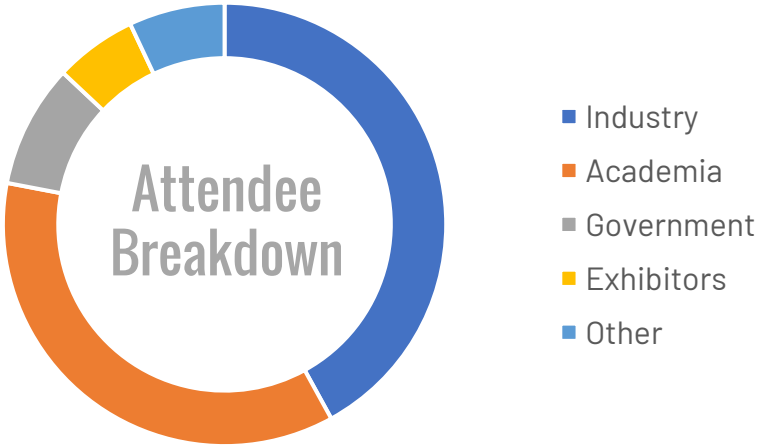

EVENTS

CIC Forum 2025

181
Total Registrants

170	174
Day 1	Day 2





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EVENTS

CIC Outreach

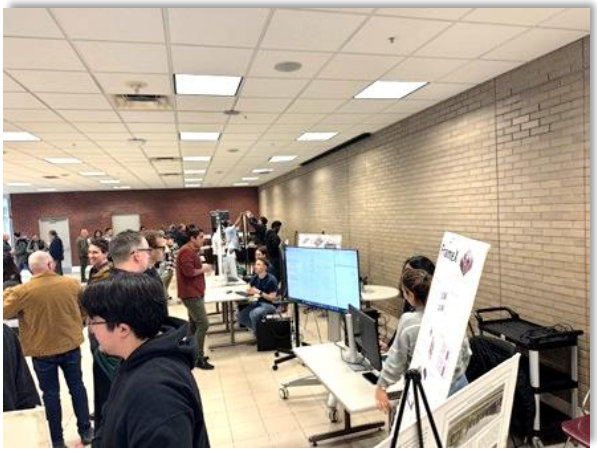
The CIC participated as an exhibitor and presenter at various conferences and events in Alberta this year to spread awareness of the CIC, and its mandates, services, and initiatives, to the broader innovation and construction communities.

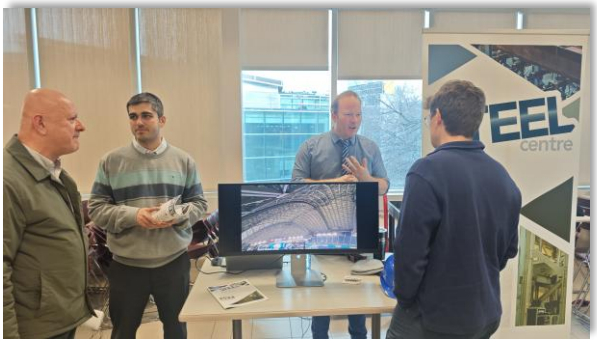
- **36th ASTech Awards Opening Ceremony and Networking Event**
- **Edmonton Unlimited Startup Week Built World Tech**
- **Robotics and Intelligent Systems Expo (RISEx) 2025**
- **COAA Annual Conference: Nation Builders 2025**
- **2nd Canadian Sustainable Additive Construction Conference**
- **Industrial Heartland Career Forum**
- **Alberta Centre for Labour Market Research (ACLMR) Forum**
- **Alberta Construction Safety Association (ACSA) Conference**
- **ECA Owner's Forum Roundtable**

EVENTS

CIC Open House

The CIC hosted an open house on November 12, welcoming a wide range of attendees to tour the CIC labs and meet our researchers. Attendees had the opportunity to visit 13 research groups and see live demonstrations of state-of-the-art equipment and ongoing research projects.





ECOSYSTEM DEVELOPMENT PARTNERSHIPS PROGRAM

Bridging the Innovation-to-Implementation Gap in Alberta's Construction Sector

The CIC has secured funding this year through the Alberta Innovates' Ecosystem Development Partnerships (EDP) Program to launch a strategic initiative to accelerate the adoption of innovative technologies and solutions in Alberta's construction industry.

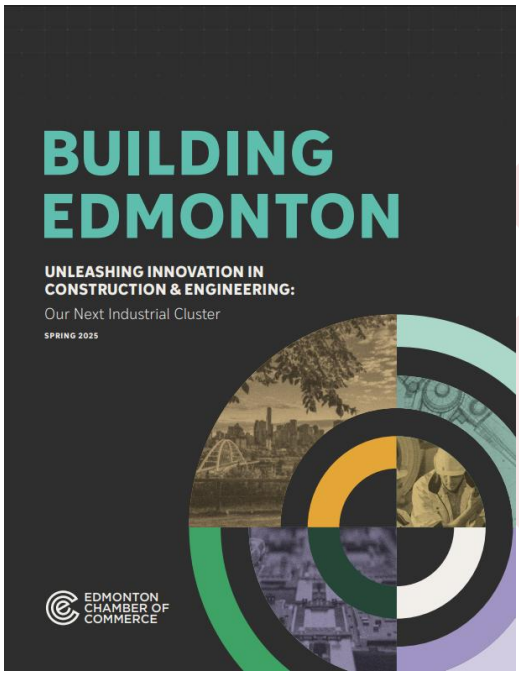
Despite substantial advances in construction research and technology development, the sector continues to face challenges in integrating these innovations into practice. This initiative addresses the critical "last mile" of innovation: transitioning validated research and emerging technologies into scalable, real-world applications. By establishing a structured **Technology Implementation Framework**, the CIC will act as a system integrator, connecting industry needs with academic outputs, supporting implementation planning, and enabling operational deployment across a fragmented sector.

COLLABORATION

AI x CE Strategy

The AI x CE Strategy is an initiative led by the Edmonton Chamber of Commerce to establish Edmonton as a global leader of construction engineering innovation, and to take advantage of Edmonton's strengths in AI and engineering research. The CIC was a key contributor to the several-point plan, which aims to advance and sustain Edmonton's advantage through leadership and collaboration, develop a future-ready workforce for innovation and productivity, build and activate infrastructure to accelerate adoption, expand capital access and scale high-growth companies, and to establish Edmonton as the global hub for AI x CE research and innovation excellence.

More information:
https://www.edmontonchamber.com/assets/pdf/AIxCEStrategyDigital

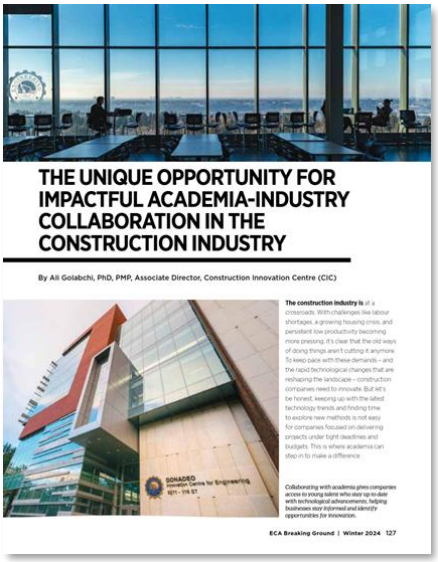


OUTREACH

Publications

The Unique Opportunity for Impactful Academia-Industry Collaboration in the Construction Industry

- By Ali Golabchi. *Breaking Ground, Edmonton Construction Association, Winter 2025*
- In this article, Dr. Ali Golabchi, examines both the benefits and the challenges of collaboration between industry and academia, and identifies practical steps that can make such collaboration successful.



From Tools to Intelligence: Building the Future of Construction in Alberta

- By Ali Golabchi. *PunchCard Systems*. November 2025
- In this article, Dr. Ali Golabchi, shares how Alberta's construction sector is embracing a new era of digital transformation powered by AI, automation, and collaboration to build a smarter and more sustainable infrastructure for the future.

INITIATIVES

SME Focus Group

As part of its ongoing commitment to supporting innovation across the full spectrum of the construction sector, the CIC has launched an SME focused group to better understand the unique challenges and opportunities faced by small and medium sized enterprises. The SME focus group brings together representatives from a diverse set of SMEs to discuss barriers to adopting new technologies, resource constraints, workforce considerations, and practical needs related to innovation and research engagement.

Insights from the focus group directly inform CIC priorities by highlighting the importance of scalable solutions, clear value propositions, and accessible pathways for SMEs to participate in applied research and pilot projects. The outcomes of this engagement are helping shape CIC programs and partnerships to ensure they are inclusive, relevant, and responsive to the needs of smaller firms.

CIC Project Spotlight

COMPUTER-VISION BASED, USER-CENTRIC, AND INTEGRATED DECISION SUPPORT SYSTEM FOR CONSTRUCTION PROJECT MANAGEMENT

Duration: 4 years
Budget: $960,000

Researchers are developing an integrated decision support system (IDSS) that provides implementation-ready, automated, real-time monitoring and control tools for both on-site construction processes and off-site fabrication.

What was the need?

Existing decision-support systems for the construction sector do not meet the needs of modern projects. Current tools are designed for static operational environments, and tend to operate in silos. This rigidity fails to respond effectively to the dynamic processes of construction, and cannot provide a holistic view of the project. This causes unnecessary safety risks, delays, increased costs, and often the inability to meet project objectives.

What was done?

Development is guided by two core principles of Lean Construction 4.0: the integration of innovative technology, and a human-centred approach that emphasizes human trust and interaction in the decision-making process. The methodology includes investigating workflows and prioritizing actionable development goals, training computer vision models to provide accurate real-time monitoring, and developing intuitive user interfaces.


Vicente Gonzalez-Moret


Gaang Lee


Qipei Mei


Farook Hamzeh

What were the outcomes?

A comprehensive IDSS that integrates advanced technologies with a user-centric design, facilitating improved productivity and safety in construction projects.

LANDMARK HOMES

CARRY STEEL

NSERC CRSNG

CIC Project Spotlight

AI-DRIVEN SOLUTIONS FOR ENHANCED SAFETY AND PRODUCTIVITY

Duration: 5 years
Budget: $900,000/year

This project is creating AI tools to automate critical aspects of construction project management, including safety and standard documentation generation and interpretation, pre-construction hazard assessments, and information management for material planning.

What was the need?

Current methods for safety and standard documentation and interpretation, pre-construction hazard assessments, and material planning still rely on substantial manual input. This can be time consuming and error prone, and cannot provide real-time feedback.

What was done?

Using digitalization and IoT (internet of things), researchers will integrate human safety, environmental factors, and resource management into a cohesive, automated, and intelligent system. The work will focus on three objectives: 1) developing an AI-powered safety chatbot to support real-time safety training, policy, and manual search on the work front, document generation and incident reporting; 2) utilizing 3D scanning and image processing to automate pre-construction site inspection and hazard assessment; and 3) enhancing the manufacturing resource planning (MRP II) system through machine learning and digital twin processing.

Xinming Li

Eleni Stroulia

Mohamed Al-Hussein

What were the outcomes?

Ready-to-use tools will include dynamic injury report analysis and automated PDA and SOP generation system, a safety chatbot, pre-construction hazard assessment apps, and a material planning system with cost estimation, inventory forecasting, and management modules.

ACQBUILT

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NSERC CRSNG

CIC Project Spotlight

TOWARDS CARBON-NEUTRAL STEEL BUILDINGS: FRAMEWORK FOR SUSTAINABLE SYSTEM SELECTION IN COMMERCIAL AND RESIDENTIAL CONSTRUCTION

Duration: 5 years
Budget: $360,000

This project is the first phase of a long-term research project that aims to develop tools for estimating and reducing embodied carbon (CO_2 released during extraction and production of materials, transportation, and the construction) in civil infrastructure systems.

What was the need?

Embodied carbon, which is estimated to be 40% of a building's total carbon emissions, is increasingly recognized as a crucial design consideration in the construction industry. Currently, however, there is no unified methodology for estimating carbon emissions in buildings, and practical information and guidelines on minimizing embodied carbon through structural and architectural design are limited.

What was done?

Using life cycle analysis, structural analysis and design tools, and artificial intelligence techniques, researchers aim to develop a tool that systematically quantifies the environmental impact of constructing steel buildings, and also to propose guidelines for selecting structural and non-structural components to minimize embodied carbon in typical commercial and residential buildings.

Ali Imanpour

Yuxiang Chen

Hossein Daneshvar

What were the outcomes?

Deliverables include databases for virtual buildings and steel building life cycles; embodied carbon calculation methodology and an improved CISC carbon calculator; and guidelines for the selections of structural systems, structural connections, non-structural components, and disassembly and reuse.

cisc icca
CANADIAN INSTITUTE OF STEEL CONSTRUCTION
INSTITUT CANADIEN DE LA CONSTRUCTION EN ACIER

CARRY STEEL

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