

Introduction – Compleccity Lab

Established in 2016, [Compleccity Lab](#) is a research laboratory in the Department of Building, Civil, and Environmental Engineering – Gina Cody School of Engineering & Computer Science, at Concordia University, Montréal. The lab has three main research clusters, namely: **Smart Construction**; **Digital Twins**; and **Smart Deconstruction** (also known as Circular Construction). The main focus of Compleccity research is technology development for digitalization, optimization, and automation of design, construction, operation, and deconstruction of the built environment. As of June 2023, there are 11 PhD students; 6 MASc students; and 3 Undergraduate Research Assistants actively involved in the three clusters of the lab. The alumni of Compleccity Lab completed 11 theses and 27 Master of Engineering projects. In less than 7 years since the launch of the lab, Dr. Mazdak Nik-Bakht, the founder and director of Compleccity, has attracted close to \$1.3M in funding (as the PI or co-PI), with another \$1.72M funding proposal currently under review.

Launched in April 2020, **Smart Deconstruction** (or Circular Construction) Cluster is focusing on various problems related to the end of life of built facilities. The mission of this research cluster is technology development and application for decision-making, planning, and execution of deconstruction projects, as an alternative to traditional demolition. Reducing virgin material consumption; reusing existing components and subsystems; and supporting reverse logistics in construction are the end goals of this cluster's research program.

In the following pages, a list of **ongoing and past projects** and some of the **related publications** by the Circular Construction Cluster of the Compleccity Lab are provided. Please click on the links (🔗 Read More) to learn more about each project or get access to the publications of your interest.

For more information, please contact the lab director, **Dr. Mazdak Nik-Bakht** at mazdak.nikbakht@concordia.ca.

Smart Construction

- Construction Operation Simulation
- Construction Process Mgmt.
- Applied AI in Construction



Digital Twinning

- Building Systems Digital Twins
- Socio-technical Digital Models
- Structural Digital Twin



Smart Deconstruction

- Deconstructability Analysis
- Deconstruction Planning
- End of Life Decision Analysis
- Urban-scale Circularity



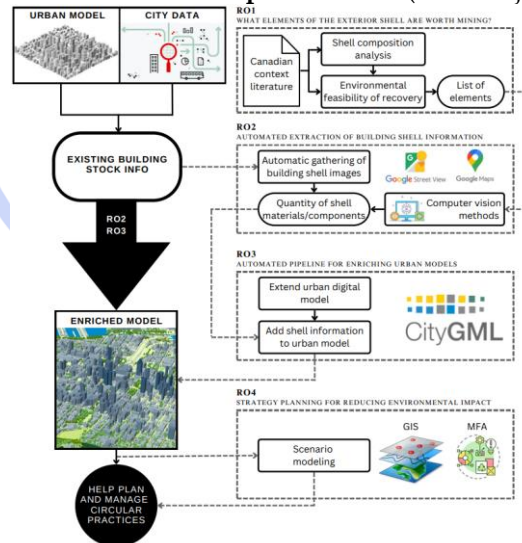
Current Projects

✓ Urban-Scale Digital Twin for Planning Building Stock Material & Component Flow (PhD Project)

Technologies involved

- Computer vision and image processing
- Data warehousing
- Geographic Information Systems (GIS)
- Agent-based Modeling and Scenario Planning

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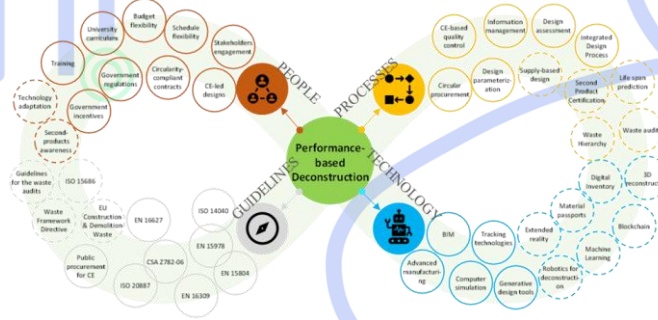


✓ Performance-based Deconstruction – A Decision Support System for Deconstruction based on Second Life Fair Market Value (PhD Project)

Technologies involved

- Data Mining
- Machine Learning
- Fuzzy Expert Systems
- Multi-Criteria Decision Analysis

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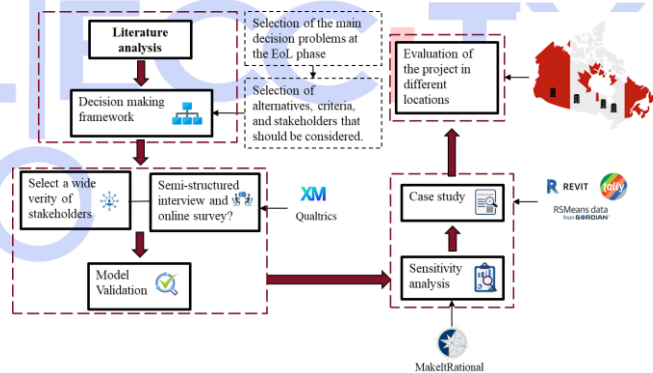


✓ A Multi-Criteria Decision-Making Model for Built Facilities' End of Life (MASC Project)

Technologies involved

- Analytic Hierarchy Process (AHP)
- Semi-structured Interviews
- Surveys
- Building Information Modeling (BIM)

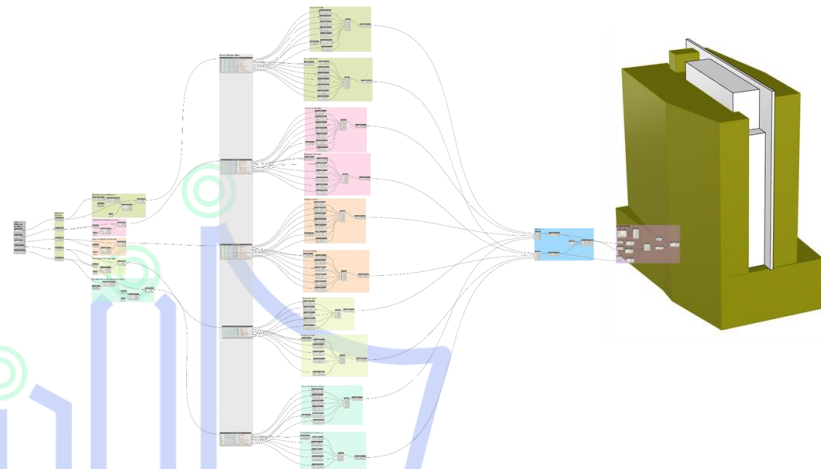
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✓ Deconstruction Assessment through BIM (Building Information Modeling)

Technologies involved

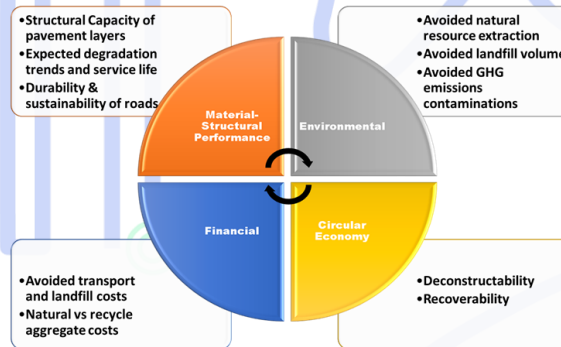
- Building Information Modeling
- Data Mining
- Open GIS (CityGML)
- Open BIM (Industry Foundation Classes, IFC)



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✓ Evaluating the Feasibility of using Recycled Concrete Aggregates in Roadway Infrastructure

Mitacs Accelerate Project
Industry partner: Lafarge Canada Inc.



[Read More](#)



Past Projects

- ✓ Automated Classification of Construction Waste by Image Processing
- ✓ A Review of Deconstruction Means and Methods – a Comprehensive Review
- ✓ Design for Deconstruction through Building Information Modeling (BIM)
- ✓ IFC (Industry Foundation Classes) Readiness to Support Circular Economy [incomplete]

Selected Publications

Deconstruction & Circular Construction – Enablers and Barriers

- A. Allam, M. Nik-Bakht “[From Demolition to Deconstruction of the Built Environment: A Synthesis of the Literature](#)”, Journal of Building Engineering, Vol 64(1) (April 2023), DOI: <https://doi.org/10.1016/j.job.2022.105679>
- A. Allam, M. Nik-Bakht, “[Barriers to Circularity in Construction: An Analysis of Expert Perspectives](#)”, CIB-W78, 40th International Conference on Applications of IT in the AEC Industry, joint with 2023 European Conference on Computing in Construction, Crete, Greece, July 2023
- J. Gomes, R. Dziedzic, M. Nik-Bakht, “[A Decision-Making Framework for the Built Facilities’ End-of-Life from Sustainability and Circular Economy Viewpoints](#)”, 10th CSCE International Construction Specialty Conference (jointly with ASCE CRC 2023), Moncton, NB, May 2023

Reverse Logistics and Circular Construction Supply Chain

- M. Nik-Bakht, C. An, M. Ouf, G. Hafeez, R. Dziedzic, S. H. Han, F. Nasiri, U. Eicker, A. Hammad, and O. Moselhi, “[Value Stream Mapping of Project Lifecycle Data for Circular Construction](#)”, 38th International Symposium on Automation and Robotics in Construction (ISARC 2021), UAE, Nov 2021
- A. Allam, M. Nik-Bakht, “[SWOT Analysis of Built Facilities’ Deconstruction Projects](#)”, 10th CSCE International Construction Specialty Conference (jointly with ASCE CRC 2023), Moncton, NB, May 2023

AI, Machine Learning and Digitalization for Deconstruction

- R. Panizza, AS. Allam, A., Kasliwal, and M. Nik-Bakht, “Labeling Construction, Renovation, and Demolition Waste through Segment Anything Model (SAM)” Construction Research Congress (CRC) 2024.
- R. Panizza, M. Nik-Bakht, “[Extraction of Energy-Influential Parameters from Building Façade Images through Google Street View](#)”, CIB-W78, 40th International Conference on Applications of IT in the AEC Industry, joint with 2023 European Conference on Computing in Construction, Crete, Greece, July 2023

Design for Deconstruction

- L. Rafati Sokhangoo, M. Nik-Bakht, S. H. Han, “[Optimizing Lifecycle Cost of Residential MOC through Generative Design](#)”, 10th CSCE International Construction Specialty Conference (jointly with ASCE CRC 2023), Moncton, NB, May 2023
- E. Asadzadeh, “[Design for deconstruction and disassembly using BIM](#)”, Master of Engineering Research Project, Dec 2021