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2020 CANADIAN CONSULTING ENGINEERING AWARDS SUBMISSION

## Shoppers Drug Mart Flagship

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Photo credit: Brook McIlroy

### PROJECT SUMMARY

Shoppers Drug Mart sought to transform an existing 19th century heritage building into a new flagship retail space. Lead architect, Brook McIlroy, engaged Blackwell Structural Engineers to design what would become Toronto's first mass timber building. Through the innovative design of glue-laminated (glulam) beams and columns and cross-laminated timber (CLT) floor panels, the building was able to maintain its original heritage façade and provide 4 storeys of warm and inviting spaces.

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## PROJECT HIGHLIGHTS

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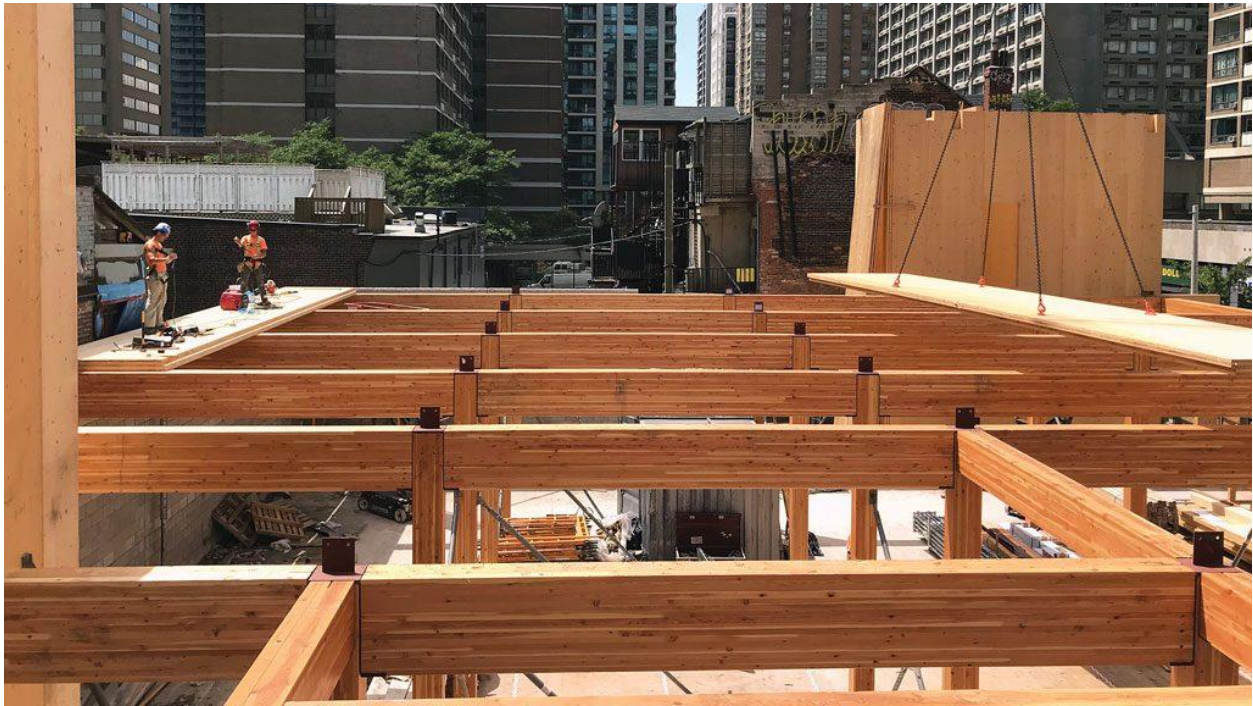
### INNOVATION

The Shopper's Drug Mart Flagship retail location at Yonge & Charles is Toronto's first mass-timber commercial building project. While maintaining the historic building façade of this heritage building, the entire structure and interior of this 4-storey, 2,800 square metre building was rebuilt.

Mid-rise commercial buildings are typically constructed with cast-in-place concrete or steel. However, early in the design process it was decided that this building would be atypical and progressive; focusing on warmth of interior, respect of historical context, and sustainability. Therefore, rather than making use of conventional materials it was decided to construct the building with mass-timber; a material that is carbon capturing, fire safe, durable, and fast and economical to construct on site with components being prefabricated. The building became the first commercial mass timber building to be approved by the City of Toronto.

The existing building was constructed in a typical early 20th century fashion, with multi-wythe load bearing brick walls supporting wood joists and beams spanning approximately 6.8 meters. The exterior multi-wythe brick walls along the north and east have heritage significance and were incorporated into the new building. Parts of the east heritage wall are supported by paired steel wide flange beams that bear on iron corbelled columns which were also maintained in the final structure.

The challenge was how to achieve the desired open-concept floor space while maximizing the head clearance, which is constrained by the location of existing wall openings. An innovative structural timber system was proposed by Blackwell - using exposed heavy timber construction, glue-laminated (glulam) beams and column with a cross-laminated timber (CLT) floor system, and unconventional CLT elevator and stair cores - typically constructed of concrete. This system provided the strength and stiffness characteristics to achieve the desired long slab spans and facilitated a warm and inviting space; including a double-height atrium on the second level, flooded with natural light through a large skylight.



Glulam and CLT Erection. Photo credit: Brook Mclroy

## COMPLEXITY

The stair and elevator cores were designed with segmented 5-ply CLT panels. It was anticipated that each CLT supplier would bid with slightly different products after the structural design was complete. Thus, the lateral design of the core walls was completed such that different CLT lay-ups and properties could be interchanged without having to redesign the system based on differing properties. The design assumed properties of the panels to be an average of 5-ply CLT panels from multiple possible suppliers.



CLT Elevator Core. Photo Credit Scott Norsworthy



The CLT panels act as nearly rigid bodies when subjected to in-plane forces. Most of the lateral deformation and ductility comes from panel-to-panel and panel-to-foundation connection; allowing for connection design to govern lateral design behavior and the panels to be effectively interchangeable. With a known ductility and stiffness of the connector, CLT wall panels could be interchanged and lateral force distribution and deflections predicted within tolerance of the original design.

Site constraints prevented exterior retention of the heritage façade. An innovative construction procedure was developed by which part of the existing structure was used as a work platform and wall retention system. Once the new footings, benching, and underpinning were completed, new columns were lowered into the building through holes in the existing structure. The new floors were designed to be 600mm - 900mm above the existing floors. This difference allowed for installation and connection of the 570mm deep glulam beams to the columns. Once the diaphragms and lateral walls were installed, sections of the existing structure were removed.



Site Construction

## SOCIAL AND ECONOMIC BENEFITS

Located in a busy downtown neighborhood, it was crucial that this pharmacy provide a welcoming and warm respite from the bustling surroundings - a comforting place for locals to access health care services.

The design team worked closely with a heritage restoration specialist, ERA Architects, to ensure that the building's historic façade and streetscape were incorporated in a manner that is inviting and proportional to its surroundings.

The use of exposed mass timber was integral to creating this inviting space. The aesthetic value of wood in buildings is self-evident. Mass timber buildings in downtown Toronto, originally constructed near the beginning of the last century, remain in use and are highly desirable today. Studies by D. Fell (UBC) and FPInnovation; Kelz et al. Austria, have demonstrated positive health and well-being benefits for occupants working in buildings with exposed wood including suppression of the secondary (fight or flight) nervous system and reduction in the stress hormone, cortisol. Exposed wood has also been proven to result in increased rental rates less vacancy time, and higher profile tenants, benefitting the building's owner from an economic standpoint.

The adaptive and sustainable considerations of this successful project benefits the surrounding community through the services of the occupants and through the bolstering experience of being in the space.



Natural Light and Exposed Timber. Photo credit: Scott Norsworthy

## **ENVIRONMENTAL BENEFITS**

At the project's outset, environmental and sustainability issues were at the core of the design approach. The decision to retain as much of the existing building as possible reduced construction waste and extended the life of this historic building; the most significant consideration for the environment and for the building's sustainability was the decision to develop a Mass Timber structural solution.

As life cycle energy demands in buildings drop due to improved technologies, the embodied energy and emissions from the initial construction become the dominant carbon cost of the project. The long-term performance and environmental benefits of the building's structure was maximized early in the design process by choosing mass timber. The embodied energy of wood is low, and wood captures the carbon of approximately one tonne of CO<sub>2</sub> for each cubic meter of wood used. In addition, the use of wood displaces steel and concrete, each of which contributes significantly to atmospheric carbon.

## **MEETING THE CLIENT'S NEEDS**

The client's main project objectives included creating a landmark flagship retail space while maintaining and respecting the existing heritage character of this historic Toronto building. The mass timber structural solution allowed the client to achieve the goal of creating an open and warm space, one that facilitates an enhanced modern customer experience. Overcoming challenges in building approvals due to the new technologies of the mass timber solution, the building is now proudly regarded as an example of how to move forward with more sustainable building design with the use of new locally sourced and renewable mass timber. The warmth of the environment has made a positive impact on the client's employees and customers.



Rendering of Exterior (Exterior photos have not been taken). Rendering: Brook McIlroy