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CANADIAN CONSULTING ENGINEERING AWARDS 2019 SUBMISSION

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York University's Schulich School of Business Expansion

Photo credit: Baird Sampson Neuert Architects Inc.

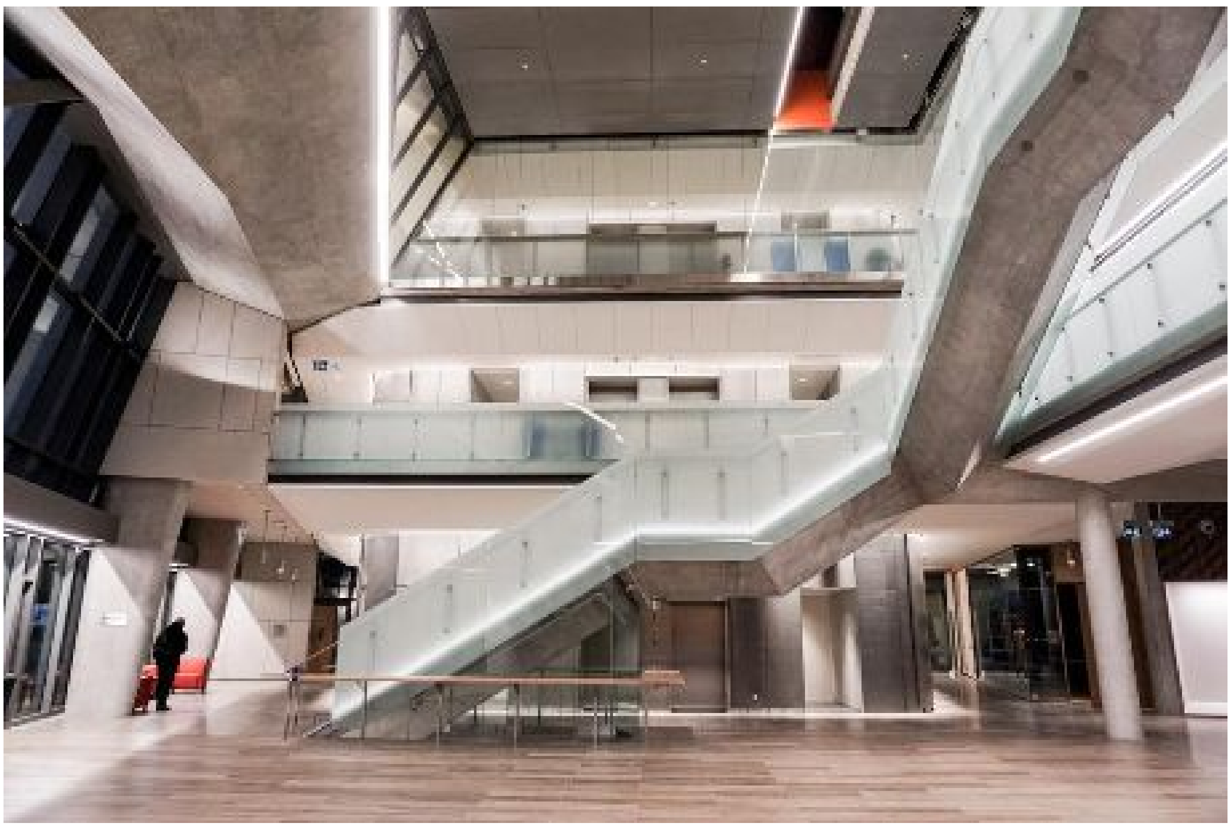
PROJECT SUMMARY

York University's major expansion of the Schulich School of Building is a new state of the art academic research and learning facility adjacent to the existing Seymour Schulich building. Designed by Baird Sampson Neuert Architects and structurally engineered by Blackwell, this 67,000 square foot facility is home to Schulich's undergraduate, graduate, and community programs.

PROJECT HIGHLIGHTS

INNOVATION

The building is organized around a multilevel social space crossed by horizontal and vertical pathways, with an open stair wrapping its edges. Various sized teaching spaces, event spaces, and breakout rooms are organized around this central space, facilitating spontaneous meetings while providing quiet work areas for students. A large LCD screen array allows connectivity with international partners during programmed events, and a café adds to the social space options. On the third floor a dramatic bridge lounge overlooks activities within the social space and is visible from the campus arrival boulevard through its tall glazed facade.



ATRIUM AND FEATURE STAIR. Photo credit: Baird Sampson Neuert Architects Inc.

CONSTRUCTION OF FEATURE STAIR.

Large classroom areas in the south wing required the structure to accommodate long clear spans (up to 12.6m) between supports. The structure was designed to make use of a one-way voided slab (600mm deep, with 400mm diameter voids spaced at 600mm on centre) to satisfy the span requirements while minimizing material use. A voided tapering slab was used for the cantilever at the south end of structure; the sloped underside was coordinated with the architectural team to provide the desired aesthetic.

The long clear 15.3m span required for the featured reception bridge lounge in the main atrium area utilized post-tensioned concrete to satisfy the strength and serviceability requirements. Designed as a fully pre-stressed non-prismatic beam with bonded tendons, the profile of ducts for bonded post-tensioning strands were coordinated with the complex member geometry, which required analysis of the structure at 18 stations along the length to capture the full member behavior. Due to the complicated geometry of the underside of the member, rebar layout was reviewed for constructability and it was determined that the stirrups at each of the 102 stations along the length of the member were to be totally unique.

BRIDGE LOUNGE CONSTRUCTION.

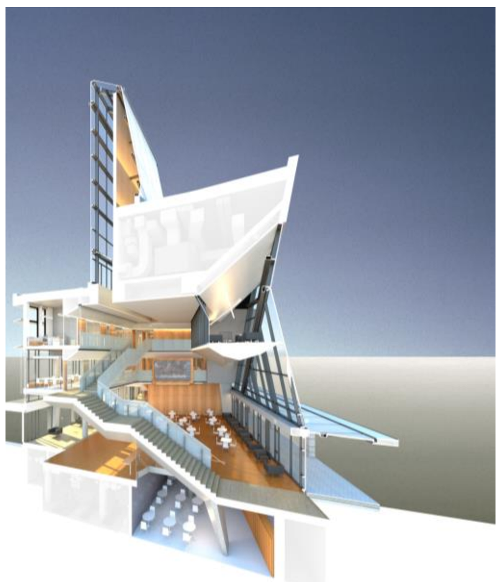
BRIDGE LOUNGE. Rendering by Baird Sampson Neuert Architects Inc.

Extending from the roof is the notable Solar Chimney feature. Reaching a height of 27.2m above ground floor, the structure of this component cantilevers 10m above the high roof. A composite system was used for the structure, with cantilever steel beam columns supporting infill cast-in-place concrete which was bonded to the steel to form a single plate element. The system was chosen to minimize the weight of the structure while satisfying the thermal mass requirements of the passive solar wall, while keeping the overall structural thickness to a minimum. Lateral support of the chimney was provided by the high roof steel structure.

COMPLEXITY

Due to the complex geometry of the structural members, it did not suffice to use traditional Finite Element Analysis (FEM) software tools for detailed analysis. A combination of hand analysis methods from first principles supplemented by simplified FEM analysis methods were ultimately used to establish the structural behavior for the most complicated elements, including the main atrium feature stair and the bridge lounge structure. These methods established ultimate strength requirements, deflection limits, and floor vibration requirements for the complex elements.

The project deliverables included a 3D Building Information Model (BIM), which would be used by the contractor for coordination and the creation of an as-built BIM model for the University upon completion of the construction phase. All of the complex member geometry was fully modelled to a Level of Detail (LOD 300) such that the exact shape, size, orientation, quantity, and interfacing with other building components were detailed.



SECTION PERSPECTIVE. Rendering by Baird Sampson Neuert Architects Inc.

In addition to the technical complexities, the project presented a logistical challenge in that it was to be completed on a fast-tracked schedule. In order to meet requirements for public funding, 16 months was allotted for construction from the receipt of the building permit to completion. Considering the ambitious nature of the building, this timeframe was extremely tight. Through a highly collaborative design process used by the consultant team and the efficient use of BIM models, coordination between disciplines was outstanding and ultimately the project was successful in meeting the expected deadlines, despite the greatly accelerated schedule.

SOCIAL AND ECONOMIC BENEFITS

Since moving the Schulich School of Business into the Seymour Schulich Building in 2003, York University's MBA program has attracted international acclaim; placing in The Economist's top 10 MBA program rankings and being rated #1 in the world in a global ranking of the top 100 MBA programs that are preparing future leaders for the environmental, social, and ethical complexities of modern-day business. The existing Seymour Schulich Building was distinguished for being the most extensively used academic space on York University's Keele campus: hosting classes year-round, seven days a week, only closing its doors from 2:00 am – 6:00 am.

The expansion of The Schulich School of Business directly adjacent to the existing Seymour Schulich Building supports the growth and innovation of one of the leading business schools in the world. The Rob and Cheryl McEwen Graduate Study & Research Building houses the business school's Research Office as well as four Centres of Excellence: the Centre of Excellence in Responsible Business, the Schulich Centre for Global Enterprise, the Brookfield Centre in Real Estate and Infrastructure, and the newly established Centre of Excellence in Business Analytics and Artificial Intelligence.

With this new expansion, business school students now have a built environment that reflects the values they will cultivate during their studies; those of sustainability, community, and modern business practices. Graduates will go on to apply these well learned values and experiences in the business world, to the economic and social betterment to their communities.

CLASSROOMS. Rendering by Baird Sampson Neuert Architects Inc.

STUDY CARRELS. Rendering by Baird Sampson Neuert Architects Inc.

ENVIRONMENTAL BENEFITS

The building's orientation, geometry, and facade design, maximize thermal energy performance and daylighting effectiveness. At the centre of the building's energy conservation system is the aforementioned Solar Chimney. The vertical glazed extension uses sunlight to warm a large interior well of air. With closed vents atop the chimney, the warmed air is forced into the building and circulated throughout, minimizing energy use for heat. When cooling, vents in the chimney are opened and a natural flow of air is created to decrease temperatures. In addition, building heating and cooling systems utilize radiant in-floor and active slab hydronics, which both take advantage of the heavy thermal mass of the concrete structure to reduce energy demand and improve occupant comfort.

SOLAR WALL CONSTRUCTION AND OPEN SOLAR CHIMNEY. Photo credit: Baird Sampson Neuert Architects Inc.

Along with the building's advanced HVAC systems, extensive green roofs were installed, and a wide range of vegetation was planted to go above and beyond meeting the City of Toronto's rigorous green roof standards. The building is currently targeting a LEED

Gold certification, the project is designed to achieve an ultra-low energy footprint of 98 kWh/m2/annum, with a 71.44% better energy performance than the Model National Energy Code for Buildings (MNECB) reference standard, and a 68% reduction in carbon emissions.

Through a highly collaborative and holistic building approach, the project was successful in delivering a sustainable building that will improve the quality of life for the students and staff on campus for years to come.

MEETING THE CLIENT'S NEEDS

The prominent objectives of the project were three-fold: integrate seamlessly with existing built environment, create a learning and research environment focused on graduate business education and interconnectivity with international campuses and collaborators, and serve as a paragon of York University's commitment to sustainability.

To achieve the goal of integration with the existing Seymour Schulich Building the expansion followed a unique building form and configuration. Curved concrete, asymmetrical geometry, and large open interior spans were featured throughout the building. Driven by the architectural design, the project presented unique challenges which required innovative and technical solutions.

ATRIUM. Photo credit: Baird Sampson Neuert Architects Inc.

Use of reinforced and post-tensioned concrete played an important role in achieving the architectural vision, as it allowed for the creation of exposed structural members with unique faceted geometries, including the atrium feature stair and the bridge lounge structure.

Post tensioned concrete transfer beams were used for long spans over the atrium space; supporting both the steel penthouse structure above and the 27.2m high solar chimney wall structure. Custom faceted concrete columns were used for the east canopy structure, and architecturally exposed concrete was used throughout the building to match the architectural language of the existing Seymour Schulich Building.

NORTHWEST VIEW OF THE BUIILDING. Photo credit: Baird Sampson Neuert Architects Inc.