Canadian Consulting Engineering Awards 2016

Tim Hortons Field (CIBC 2015 Pan Am/ParaPan Am Games Soccer Stadium)

Category A: Buildings

April 2016

ARUP

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Free-form study space on the main floor.

Online Submission Confirmation Receipt

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Cladding work.

Entry Consent Form

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Feature Staircase.

Project Information

Free-form study space on the main floor.

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Project Information

Project Name	The Bergeron Centre for Engineering Excellence (BCEE)
Project Location	York University, Toronto, Ontario
Project Size	16,215m2 gross interior area. 6 storeys, including basement and penthouse plantroom.
Year Completed	September 2015
Entering Firm	Arup
Project Partners	York University (Owner), ZAS Architects + Interiors (Architect), Blackwell (Structural Engineering), Scott Torrance Landscape Architect (Landscape Architect), Laing O'Rourke (Contractor), Gillam Group (Contractor).
Arup Contacts	Project Manger: Zoran Markovic | 416 515 0915 | zoran.markovic@arup.com Project Director: Richard Terry | 416 515 0915 | richard.terry@arup.com Marketing Contact: Kirsten Warren | 647 260 3436 | kirsten.warren@arup.com

Bird's Eye view: Construction on a complex, operational site.

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Top: Flexible laboratory space.

Bottom: Flexible studio-like space.

Project Summary

(1) 75-Word Summary

York University desired an innovative, sustainable building that would create exceptional “Renaissance Engineers” of tomorrow. Arup (with ZAS Architects) provided structural, mechanical, electrical, and civil engineering services, and IT/communications and security consulting. On track to achieve LEED Gold, the building includes innovative foundations, specialized laboratories, green roof, and sophisticated mechanical, lighting and stormwater management solutions. Flexible learning spaces provide an collaborative student environment, with the building itself acting as a learning tool for students.

Cladding work.

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Three-storey civil lab with strong wall and floor.

(2) Project Highlights

Q1. Innovation

Creating a unique building like the Bergeron Centre for Engineering Excellence challenged the team to think outside of the box to provide truly innovative design ideas.

Foundations and Civil Engineering Laboratory

The building is founded on a hybrid system of foundations that include spread footings and deep pile foundations. Special concrete was used to provide a waterproofed environment for the basement spaces at level 0. In addition, footings were placed underneath sensitive equipment, with surrounding neoprene isolation to minimize the transmission of vibrations.

The building includes a triple-height civil engineering lab which is structurally isolated from the remainder of the building to minimize the transfer of noise and vibrations. It is also equipped with a strong wall and floor to accommodate the forces imposed by the hydraulic test equipment. The equipment is used to test to destruction prototype structural elements and construction materials like concrete and steel. The strong floor is 1m thick, while the L-shaped strong wall is 6m high and 1.5m thick. These elements incorporate a grid of anchor holes to facilitate fixing of the specialist machinery used for testing.

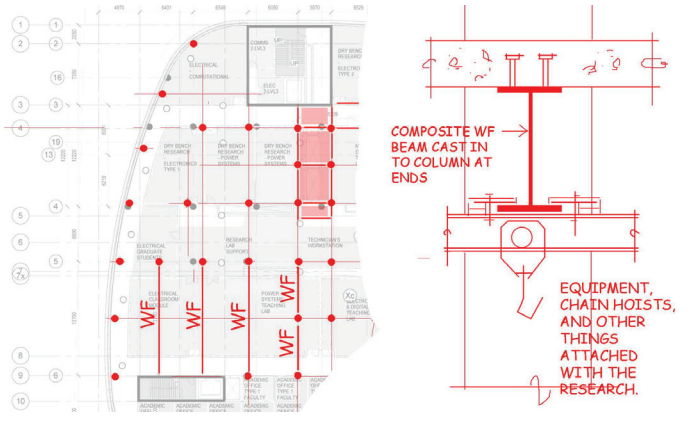
Other structural highlights include special daylighting tubes that were designed to be founded in the level 1 slab to allow natural lighting to enter the workshops and laboratories at level 0. An underground utility tunnel links the basement level to an adjoining building. It was designed to accommodate heavy traffic and truck loading during the construction phase.

Mechanical: Heating and Cooling, “Clean “ Room

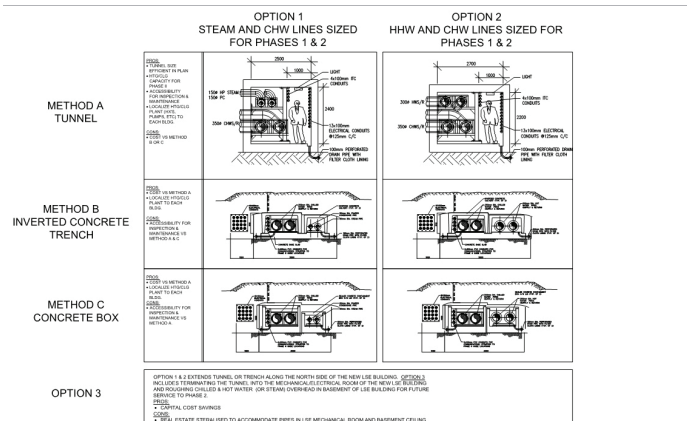
The heating requirements for the building are met by the university campus central steam plant, with heat exchangers used to generate heating hot water. Heating to the building is provided through terminal devices such as trench heaters under double and triple-height glazing, through radiant ceiling panels within perimeter laboratory and classroom areas, and through the ventilation systems in central areas.

The building’s cooling requirements are served from the campus chilled water central plant which nominally runs from spring through fall. A dry cooler is provided at roof level to meet the cooling requirements for the laboratory process loads and for the 24/7/365 cooling associated with the IT and electrical rooms.

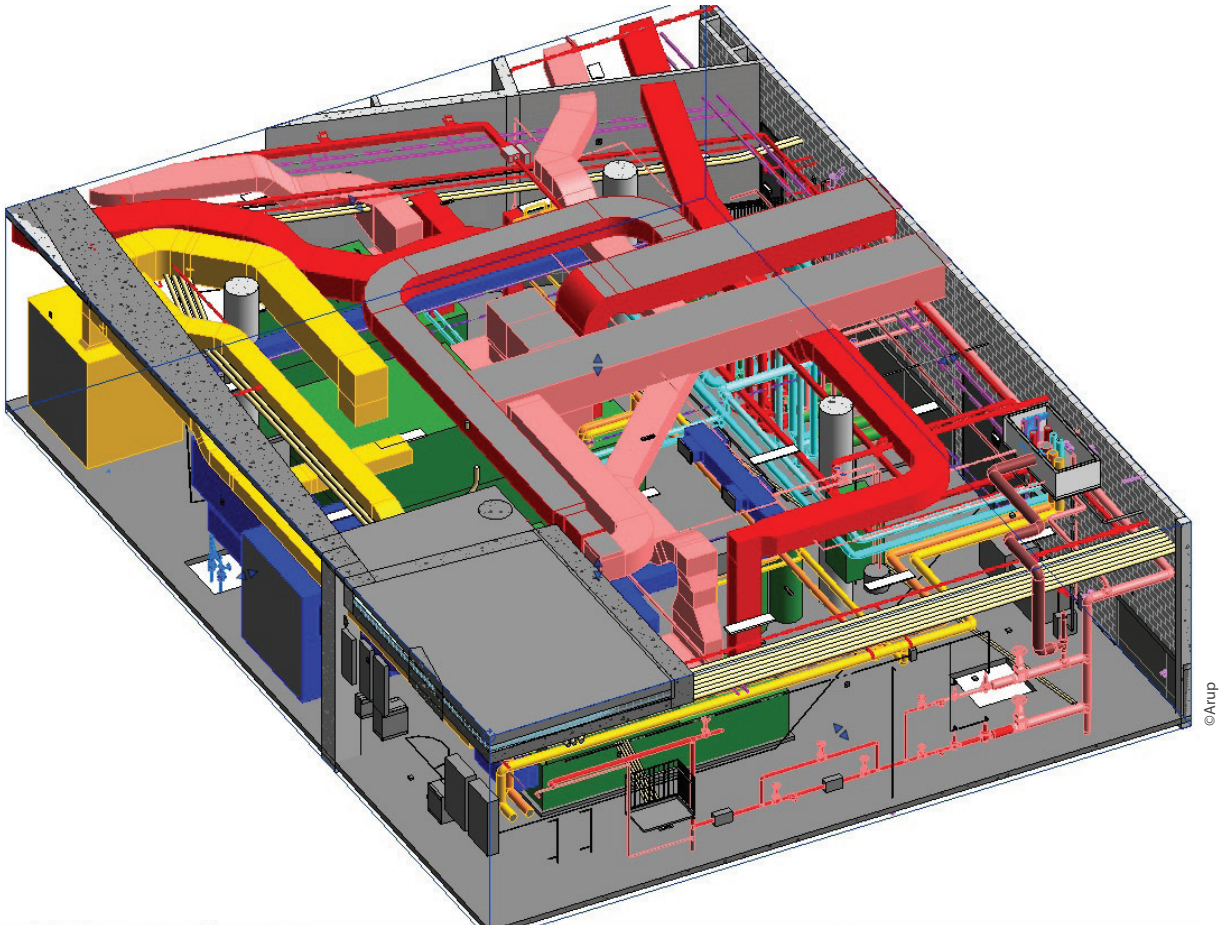
A “clean room” (a laboratory with a very low level of environmental pollutants) rated at ISO Class 7 filtration levels (out of 9) is provided with its own dedicated air handling plant. In addition, three environmental chambers located in the building can each provide individual tight temperature control from 85°C down to -35° C to facilitate experiments.



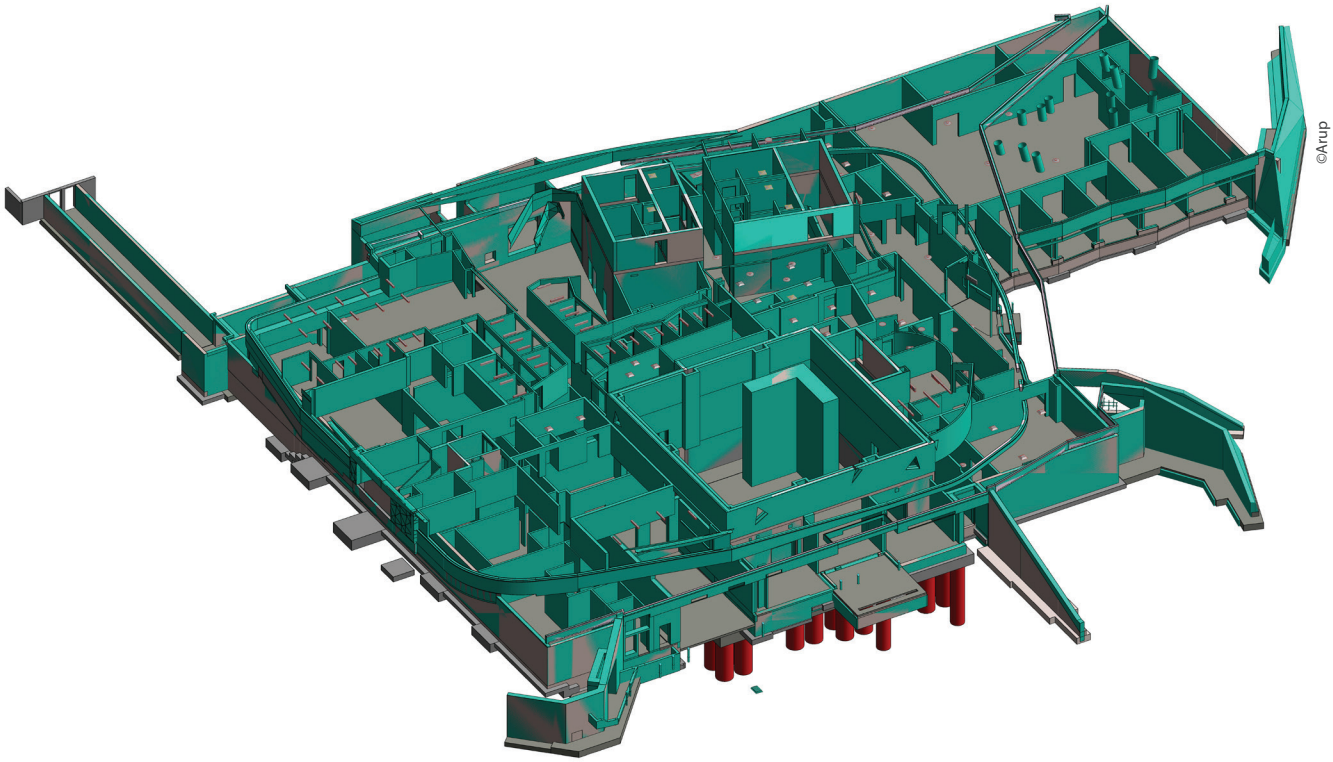
High Bay Lab - early concept design.



Sketches of Preliminary Service Options.



Basement mechanical room.



3D structural drawing featuring the civil engineering lab and unique foundation piling.

Project Highlights

Q2. Complexity

The project was technically complex, and several engineering challenges were addressed to achieve the university's vision and objectives for the building, resulting in unique solutions.

Site Preparation

The engineering team developed an early enabling works package to expedite relocation of the deep underground storm and sanitary sewers, servicing approximately 50% of the campus, which facilitated an early start to the building foundation works and helped to aid a constrained construction schedule. Diversion of deep sewers required careful consideration of impacts to adjacent foundations, building loads, as well as installation sequence to minimize service disruptions for the campus.

Intricate Storm Water Management

One of the main challenges of this project was to minimize the footprint of the storm water management system. This was accomplished by designing a two-pond system to offset peak runoff flows from different areas of the site. Each dry pond was integrated into the site to complement new retaining walls and landscape features, and situated to maximize site flexibility for the project and any potential future development in the area. Incorporation of a green roof and underground infiltration chamber system, also promoted on-site rainfall retention and groundwater recharge, ensuring that the increased imperviousness of the site would not increase storm water flows to the downstream storm water management pond, Stong Pond, which was already at maximum capacity.

Project Management

Because the project had no flexibility in the schedule - the building had to be open for students by September 2015 - Arup was required to fast track the procurement of the individual trade packages, which was carried out successfully. Using a 'design-assist' approach to constructability, the project team conducted a number of workshops at key project milestones with the architect and contractor to address constructability issues.

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Free-form study space.

Project Highlights

Q3. Social and/or Economic Benefits

The Bergeron Centre for Engineering Excellence has an ambitious goal to educate future "Renaissance Engineers": entrepreneurial engineers with a social conscience and a sense of global citizenship.

York University's ambition is driven by a new vision of what engineers can be and how they learn. Dean Janusz Kozinski, P.Eng., explains that its mandate is to create engineers who are "rational, ingenious, passionate, confident, and creative," who will ultimately contribute to the greater good of society.

These ideals are to be achieved by completely reversing the conventional teaching approach. The BCCE challenges the tradition of engineering buildings that define and confine students by discipline, and creates inviting indoor and outdoor spaces for social connections and academic discourse. There are absolutely no lecture halls - students view lectures online. While at the centre, students learn by interacting and experimenting in an open and friendly environment.

It is simple fact: The greater the percentage of the population with higher education, the better off Ontario will be. In an information and service-based economy like Ontario's, it is essential that future generations are challenged to become more informed, integrated and adaptable than those who came before. The education of more engineers, helps to drive the province's economy by providing a wide array of services and expertise that are of benefit not only in providing solutions to technical problems, but also in providing strategic advice for economic sectors such as energy, resource development, environmental protection and manufacturing.

The BCEE, as a unique physical manifestation of the vision for the Lassonde School of Engineering, will help create this "new breed" of engineers who are poised to contribute ever more meaningfully to society.

Flexible studio-like space.

Project Highlights

Q4. Environmental Benefits

The Bergeron Centre for Engineering Excellence was designed to meet minimum LEED Silver certification and is currently on track to achieve LEED Gold.

The BCEE was designed to achieve minimum LEED Silver certification and is on track to achieve LEED Gold.

Low energy features include both passive and active techniques:

- The façade is designed to minimize heat loss during winter and allow solar energy from low angle sun to enter the building.
- Cable routes are provided and there is structural capacity for proposed solar panels to generate electricity at roof level.
- Glazing on the building minimizes solar gain to the building in the summer. Areas with high internal gains are located on the north side of the building. A green roof minimizes the solar gains and rainwater runoff.
- Allocation of space on the penthouse level for photovoltaic panels to reduce dependence on the electrical grid. High efficiency LED lighting is also used throughout the facility for energy savings.

The mechanical systems provide energy efficient performance by incorporating demand control ventilation, variable speed fans and pumps, and airside energy recovery. A laboratory exhaust system features variable speed highly efficient fans and motors, and incorporates a heat recovery system that meets 100% of the make-up heating load in winter.

The building lighting control is a mix of sophisticated central relay based control and local dimming/switching touch screen control. The system manages light levels in every space based on occupancy, daylight levels and time of day scheduling.

Switched receptacles in office spaces, allow for automatic shut-down of monitors, desk lamps, and other devices when the room is unoccupied - resulting in reduced energy usage.

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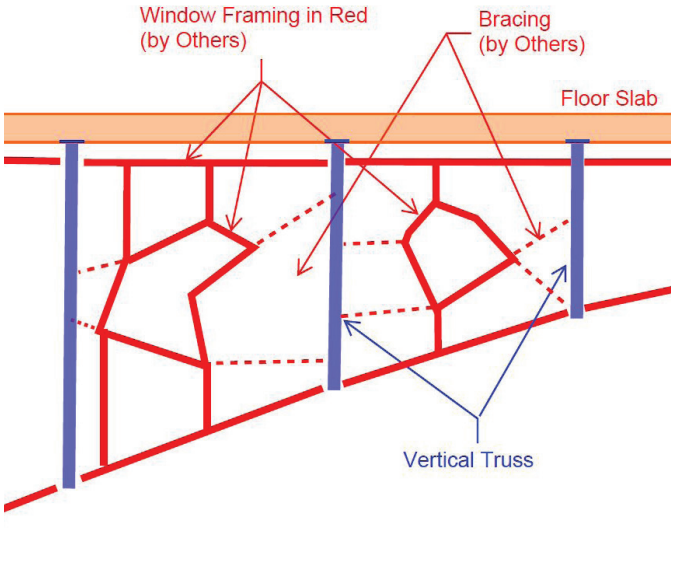
3D drawing of building with green roof.



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Curtain wall supports - early concept design.

Project Highlights

Q5. Meeting Client's Needs

The Bergeron Centre for Engineering Excellence was designed to create "Renaissance Engineers: entrepreneurial engineers with a social conscience and a sense of global citizenship."

York University wanted to create an innovative, sustainable and cost effective building that would teach and train exceptional "Renaissance Engineers" of tomorrow. This, paired with the development of a multidisciplinary curriculum that integrates learning with industry and the global engineering community, was to transform the student experience.

As engineering is a new program for York University, the faculty was brought on board when the project was under design. Arup and ZAS Architects assisted York University with a collaborative process to get the input of new faculty members into the planning and development of the new building to ensure that stakeholders needs were met.

Because the project had no flexibility in the schedule - the building had to be open for students by September 2015 - Arup was required to fast track the procurement of the individual trade packages, which was carried out successfully.

The building achieved sustainability in design ensuring low operating costs. Additionally, the use of BIM as an engineering design tool allowed for the pre-fabrication of materials, thereby minimizing on-site work, improving quality and reducing project costs. The building itself is a learning tool, with ductwork, piping and other physical examples of engineering completely exposed and on display.

York University has a building that not only provides a fluid, interactive and unique learning experience for students, but also does so in a sustainable and innovative way. Through technical and sustainable design, the BCEE was delivered as a "stunning" (BlogTO) project that was on time and within budget.

Open-concept space for students.

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Arup
2 Bloor Street East
Suite 2400
Toronto, ON
Canada
t +1 416 515 0915

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