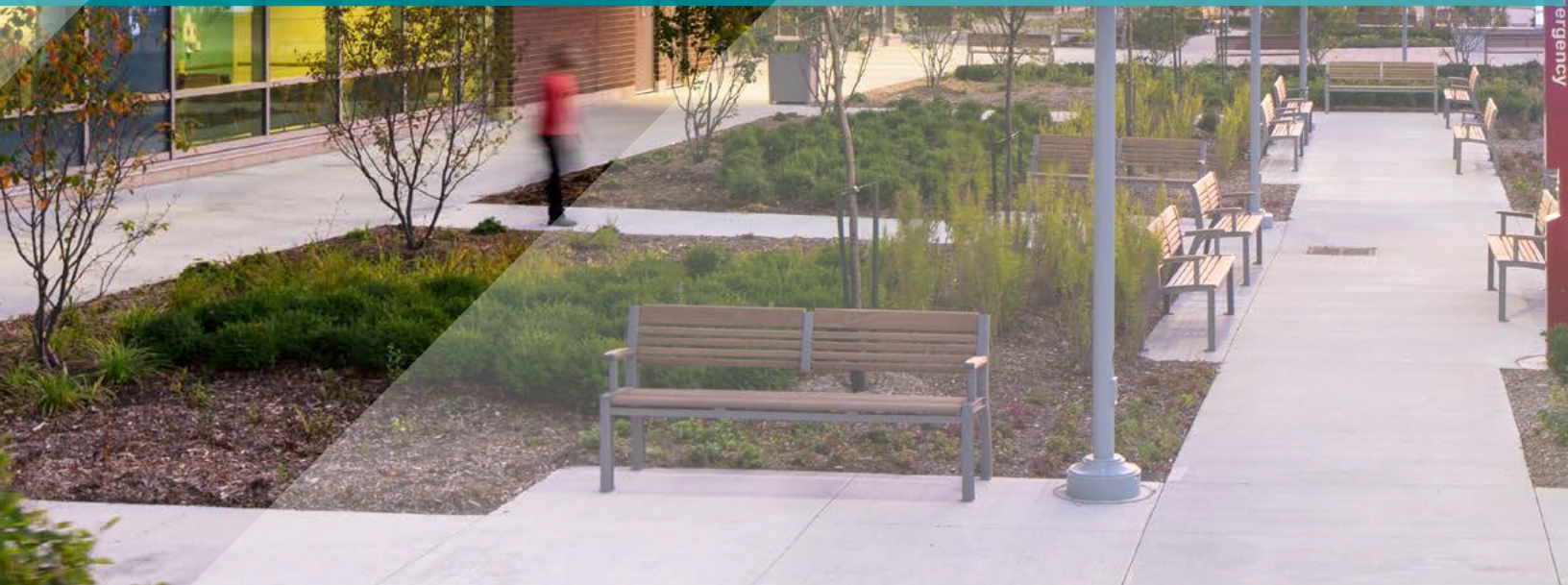


HUMBER RIVER HOSPITAL

CANADIAN CONSULTING ENGINEERING AWARDS 2016





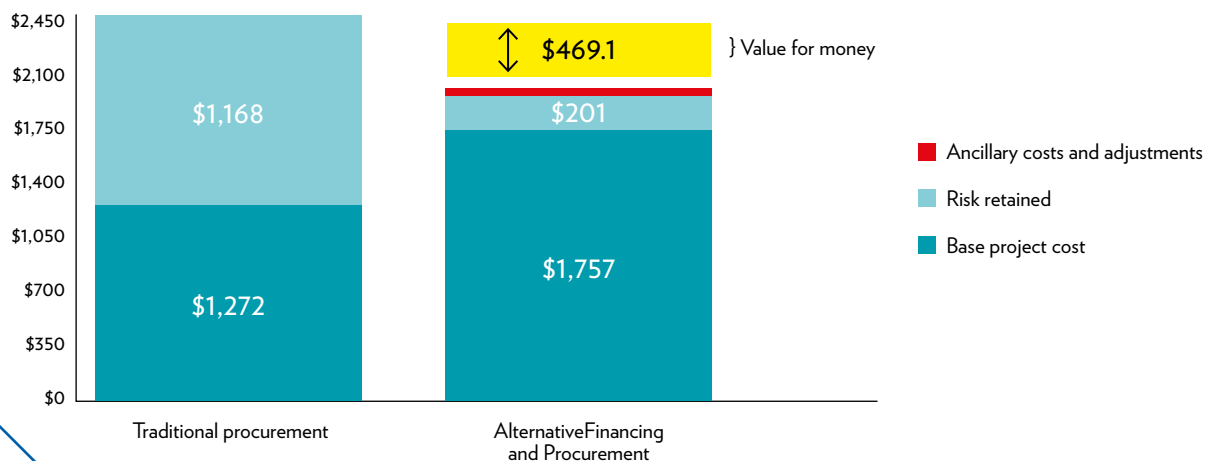
PROJECT OUTLINE

Toronto's Humber River Hospital is one of Canada's largest healthcare infrastructure projects. The first fully digital acute care hospital in North America, it is an Alternative Financing and Procurement venture through Infrastructure Ontario. Serving as a benchmark for future infrastructure project funding, integrated healthcare and sustainable design, the \$1.8-billion, 167,225-square-metre facility provides acute care hospital services to over 850,00 people in northwest Toronto. WSP provided structural and enclosure engineering, commissioning, sustainability and energy efficiency consulting.

INNOVATION

Innovation is at the root of Humber River Hospital (HRH). As an AFP venture which represented a \$469 million (19.1 percent) cost savings over traditional project delivery, the project is known for its innovative funding method where numerous design innovations were made in order to meet a strategic timetable set by the DBFM partnership with Plenary Health Care Partnerships (PHCP) and PCL.

\$ MILLIONS



HRH is the first fully digital hospital where all patient care processes are designed to be paperless. The building is also designed to operate with reduced water and energy consumption—33 percent and 40 percent less, respectively, from reference model baselines. The sustainability features of the facility are highly conducive to the hospital's integrated healthcare model.

The theme of innovation continues in the concrete structure of the building: the lack of permanent expansion joints makes this project unique. Normally, with buildings of this size, expansion joints or pour gaps are used to allow shrinkage. Instead of permanent expansion joints, temporary movement joints were used. Once the concrete contracted, the slabs were connected to complete the floor diaphragm. This preserved the structural integrity during construction, while eliminating the need for expensive expansion joint hardware.

In order to address settling and geotechnical variables, the foundation also had to be unique in design. By employing two different systems, a raft slab for the tower and 5,500-millimetre wide strip footings for the podiums, construction was able to proceed in a very timely manner, enhancing project efficiency. Pouring the tower slab took three massive pours, with one lasting 13 hours.

Automated Guided Vehicles (AGVs) are a unique feature of HRH. The vehicles transport food, linens, medications, and other supplies, and are capable of handling loads of up to 600 kilograms. The structural issue with AGVs was ensuring that the floor flatness and deflection were in line with the AGV requirements.

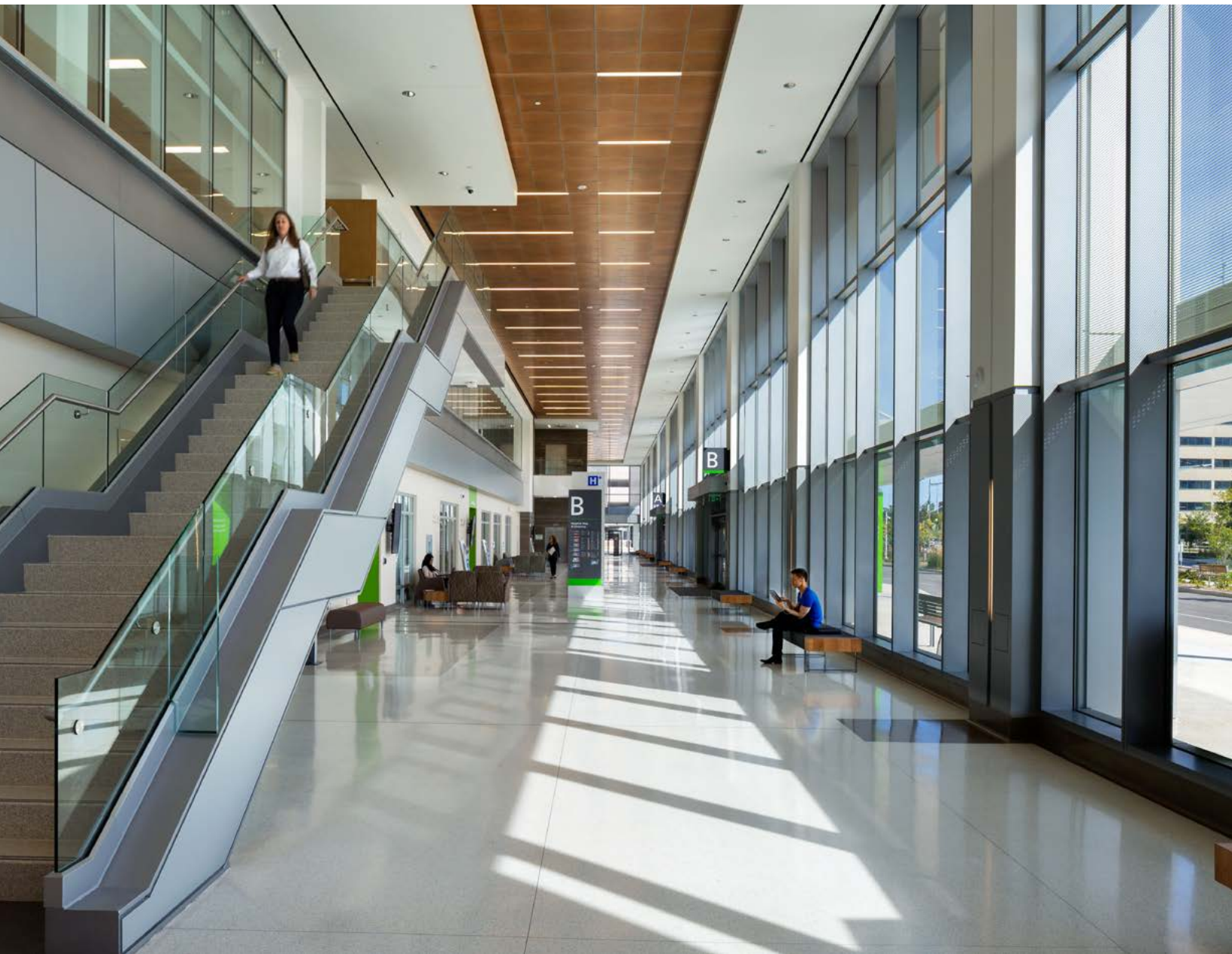
Another challenge was in designing a precast concrete panel wall system that provided a traditional rain screen all while significantly reducing the construction schedule. The building uses 12,000 square metres of precast concrete as part of its 33,400-square-metre exterior envelope. Not only selected for their aesthetic capabilities but also their ability to support the rigorous functional requirements, including sound transmission, thermal efficiency, durability and ease of construction, the precast concrete panel wall system provided traditional rain screen performance, which allows for the removal of moisture from the cavity wall via internal flashing and a series of weeps at horizontal joints.



COMPLEXITY

HRH comprises a 14-storey in-patient tower and two 6-storey podiums totalling 6,000 rooms and 656 inpatient rooms – 80 percent of which are single patient rooms: the rest are double occupancy. The large scope of the project and an accelerated construction phase of 43 months (14 months for the ‘concrete’ component) meant that the upper floors were still being designed as the lower ones were being built. Project management was a challenge through which WSP’s ability to coordinate and leverage engineering and drafting expertise from across the country were proudly showcased. We were able to put into practice the use of innovative design principles while maintaining trust and open communication with our partners throughout the delivery process.

The rigorous construction schedule was met by streamlining design, quality control processes, and development of shop drawings with Revit modeling, as well as by introducing flexibility in the design process to accommodate modular designs. WSP also provided design advice on the detailing and selection of various cladding systems, from curtain wall and roofing to precast concrete and metal panels. The use of precast concrete meant that while the cast-in-place concrete structure was rising on site, the precast concrete panels were being cast concurrently in the factory. This method allowed for installation via cranes which minimized the need for exterior scaffolding, further reducing construction time.



SOCIAL AND/OR ECONOMIC BENEFITS

Serving a catchment area of 850,000 people in northwest Toronto, and encompassing one of the most dense and multicultural regions of Canada, HRH is projected to see approximately 130,000 visits to the emergency ward in its first full year of operation.. HRH provides optimal care across a wide range of acute care services, including in the areas of cancer treatment, emergency services, dialysis, women and children's health services, and mental health for both in-patient and outpatient programs.

The project has been a catalyst for the renewal of the entire Government of Ontario campus located on the corner of Keele Street and Highway 401 in northwest Toronto, and has also spurred the development of new condos, townhouses and parks in the vicinity.

Counting over 3,400 staff, almost 600 physicians and 650 volunteers, the wellness of the facility's occupants is a major priority for HRH. That is why the design of the facility incorporates as many opportunities as possible for patients, visitors and the hospital team to immerse in the natural environment. The open spaces feature native adaptive vegetation and walking paths.. The hospital uses 100 percent fresh air; there is no recirculation. The use of low-emitting materials helps protect occupants from harmful volatile organic compounds and improves indoor air quality. Functional parameters—such as ensuring the sight lines for staff to monitor patients more effectively, and incorporating places of respite for staff and patients both within the facility and on campus, promote a balanced healing process and a high-quality work environment.





ENVIRONMENTAL BENEFITS

HRH is designed to be among the most energy efficient hospitals of its size in North America, at 40 percent below ASHRAE 90.1-2007. Adding to increased energy savings are automated climate and lighting controls; condensing boilers, high-efficiency chillers, variable-speed drives and pumps throughout, the use of heat recovery chillers to provide low temperature heating; efficient duct design to reduce static pressures, exhaust air heat recovery, a high-performance building envelope that includes increased insulation levels in the roof and walls, and electrochromic windows; lighting design featuring energy efficient lighting including LED's which provides a building average lighting power density of 0.75W/sq. ft.

Low-flow plumbing fixtures were incorporated into the building design, resulting in 33 percent potable water use reduction compared to the LEED baseline. While the site features a number of pedestrian-oriented landscaped areas, the plants selected were chosen to ensure minimal water demands. All irrigation is provided by a rainwater harvesting system that collects rainwater from the roofs, expected to save approximately 450,000 litres of potable water each year.

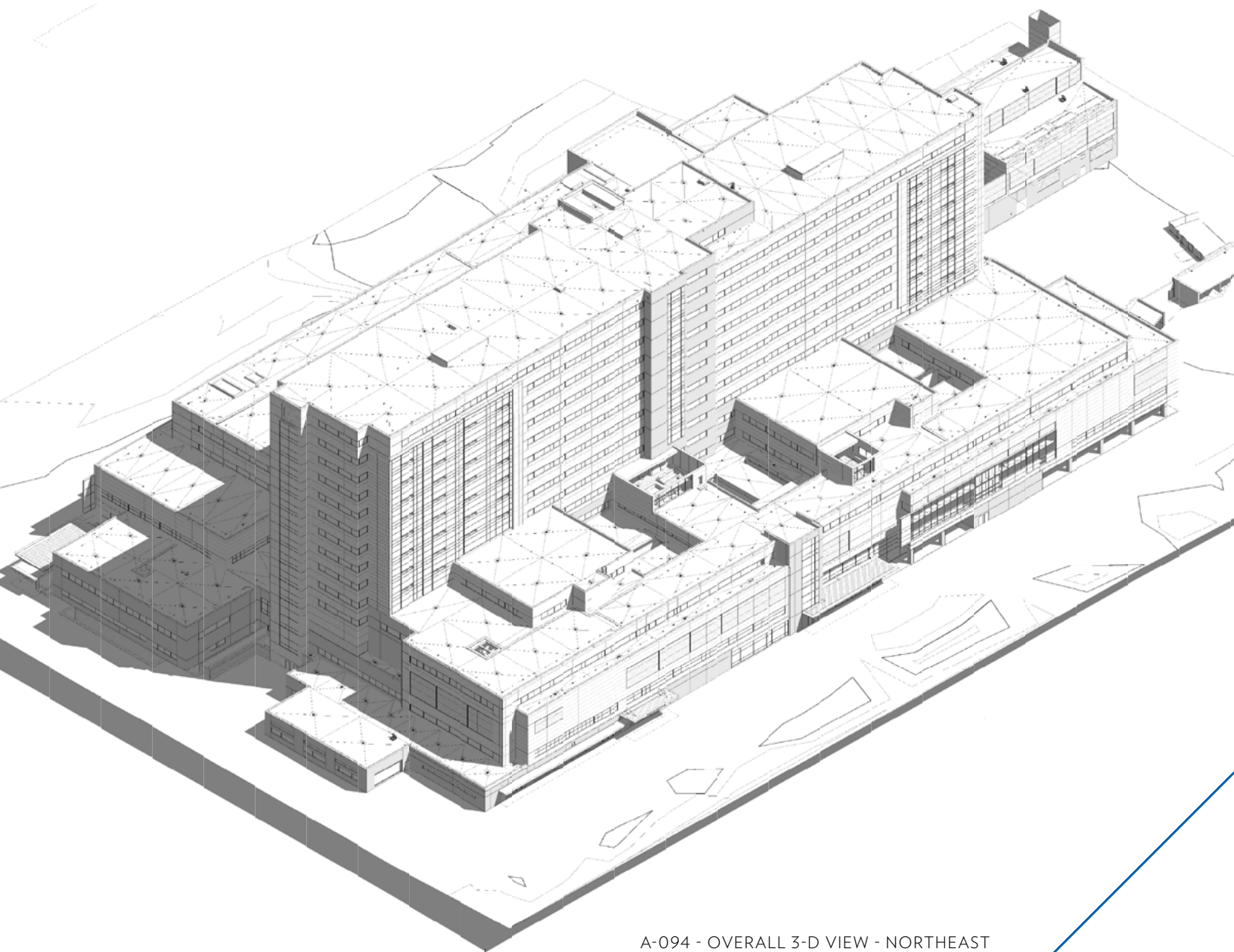
In addition to operations being paperless, green practices during the build include the diversion of 95 percent of construction waste from the landfill; the use of low volatile organic compound materials for adhesives and sealants, paints and coatings, and carpets; and other environmentally focused practices.

MEETING CLIENT'S NEEDS

The overall project design took into consideration the broader goals of HRH, the Ontario Ministry of Health and Long-term Care and the City of Toronto. This included a number of strategies to enhance the hospital environment and to focus on patient centered care, neighborhood integration and incorporate sustainable design features that minimize environmental impact.

The project design was also based on the client's three main project objectives: lean, green and digital. 'Lean' highlights the functional efficiency of the hospital; 'green' refers to the reduction of the hospital's environmental impact ; and 'digital' as the entire facility leverages the latest medical technology to improve efficiency, accuracy, reliability, safety and customer service.

HRH has been designed for tomorrow; it is built to meet the requirements for Tier 1 of the City of Toronto's Green Standard (TGS) and is targeting LEED Canada NC 2009 Silver certification. In operation since October 2015, the actual operational energy consumption has been monitored and annualized to a predicted 475 kWh/m² per year, which is a 37 percent reduction in consumption when compared to the SCIEU average for hospital buildings in Ontario. The building operation is being continually monitored and tweaked, with the goal of achieving an EUI of 348 kWh/m² per year.



A-094 - OVERALL 3-D VIEW - NORTHEAST

