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CANADIAN CONSULTING ENGINEERING AWARDS 2014

University of Toronto
Rotman School of Management

Smith + Andersen

PROJECT SUMMARY

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The world renowned Rotman School of Management at the University of Toronto was experiencing rapid growth and required additional space for specialized lecture, student gathering and high performance research. Smith + Andersen provided comprehensive mechanical and electrical engineering services and worked diligently to design a world class institutional building providing the University with spaces that would enable the University to flexibly adapt to future changes in the delivery of education.

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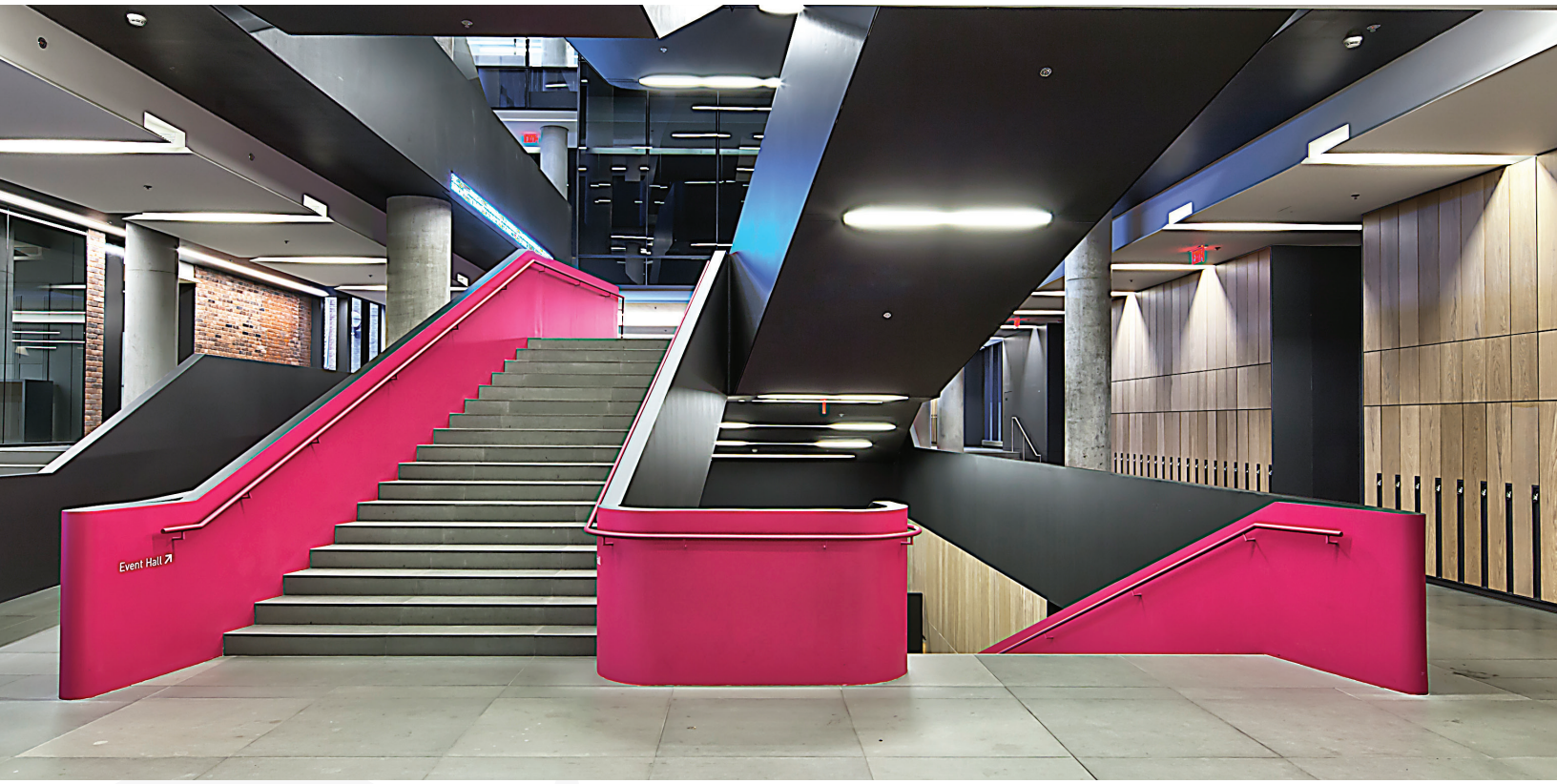
INNOVATION



One of the building's main architectural/structural features is the large interconnecting stair. The atrium links the new addition to the existing five storey business school. The challenge was to develop a hybrid smoke control system that would prevent smoke from the open floor below from deflecting onto other floors creating a hazard for occupants attempting to exit the building while ensuring pressurization was maintained in the existing building. In addition to the standard strategy of exhaust at the top of the interconnected floor space, smoke was exhausted from a low level along with air barriers which consisted of a series of continuous air curtains, around the perimeter of the atrium to. This prevents smoke from deflecting onto the floor plate adjacent to the top of the atrium. The system had many operational scenarios and the decision was based on where the fire alarm system detected the smoke within the building. Utilizing air curtains to protect people on the upper floor of the interconnected space had not been used previously and required detailed engineering and testing to ensure the system was accepted by the Authority Having Jurisdiction.

In order to optimize energy performance and necessary variable loads, air handlers are primarily variable air volume units. These allow for very tight control of space conditions and reduced fan energy during non-peak periods. The classrooms make use of theatre seating with underfloor displacement ventilation. A wrap-around heat pipe was incorporated into the classroom air handler cooling coil to recover and reheat cooling air to control humidity in the classrooms; ensuring supply air was not too cold as it is directed into the occupied zone. All air handling units incorporate a demand control ventilation strategy utilizing carbon dioxide sensors throughout the spaces optimizing ventilation rates to suit occupancy levels, consequently reducing energy consumptions.

Additional energy saving measures include highly strategic designs, variable speed drives on the heating and cooling distribution pumps, a free cooling open-cell cooling tower, and enthalpy wheels within the air handlers for pretreating outside air. A complex building automation system controls and optimizes the building's mechanical systems and includes strategies such as night cooling, economizer, morning warm-up and supply air and water (heating and chilled) temperature reset based on space and ambient temperatures.

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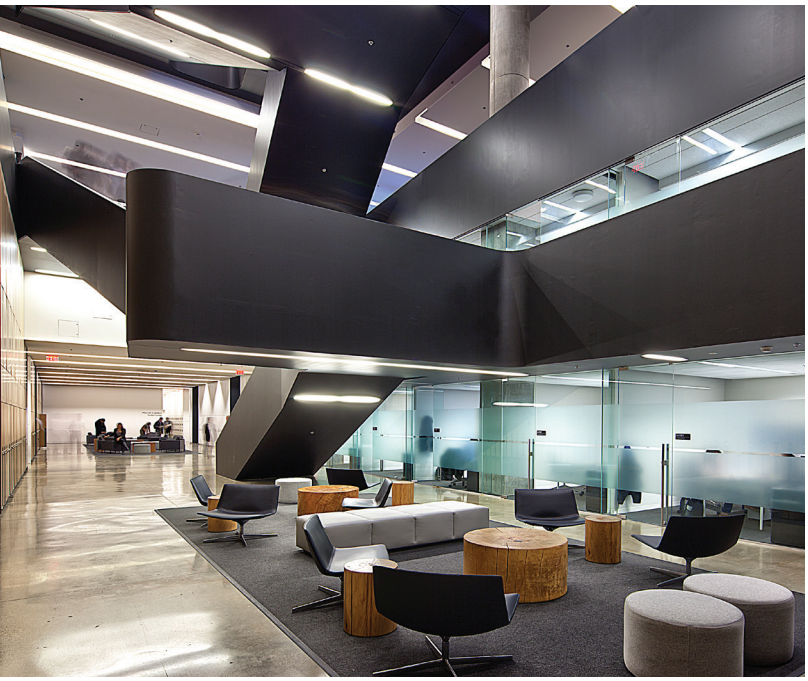
COMPLEXITY



Integration with the existing building poses inherent challenges and the Rotman School of Management was no exception with the interconnection of three existing buildings. The low floor-to-floor heights within the existing five storey buildings had to get creative and execute increased coordination to ensure all building services would fit especially with areas requiring oversized ductwork for acoustical purposes.

One of the building's main architectural/structural features is the large stair within the atrium, linking the new addition to the existing five-storey business school. A challenge was to create a hybrid smoke control system that would prevent rising smoke below the stair from deflecting to other floors. Without this system, deflecting smoke on other floors would create a hazard for patrons exiting the building. The solution involved exhaust from either the top or bottom of the atrium based on where the fire is detected and the use of air currents around the atrium to prevent smoke from migrating on to the floor.

The existing building is electrical distribution fed three separate facilities. Through careful analysis of the loads, along with implementing energy efficient measures, the new building was able to be fed from the existing distribution. In order to re-use the existing generator, a load management system was implemented in the existing and integrated into the new facility to ensure the generator was never over loaded.

Integrating air conditioning into the 19th century heritage residence required a high level of coordination with the design team in order to allow ductwork to navigate the existing wood/steel structure.

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SOCIAL AND/OR ECONOMIC BENEFITS

At the Rotman School of Management, the staff and students benefit from a high quality educational environment where the leaders of tomorrow begin and grow their illustrious career.

The facility is highly sought after as a University gathering space and public use event space with everything culminating into the main atrium and the two-storey event space on the second floor.

Through the use of various sustainable initiatives, including a complete building flush-put prior to occupancy, the design team delivered an energy-efficient, highly sustainable building which attracts students from all over the world and will save the University of Toronto operation costs over the life of the building.

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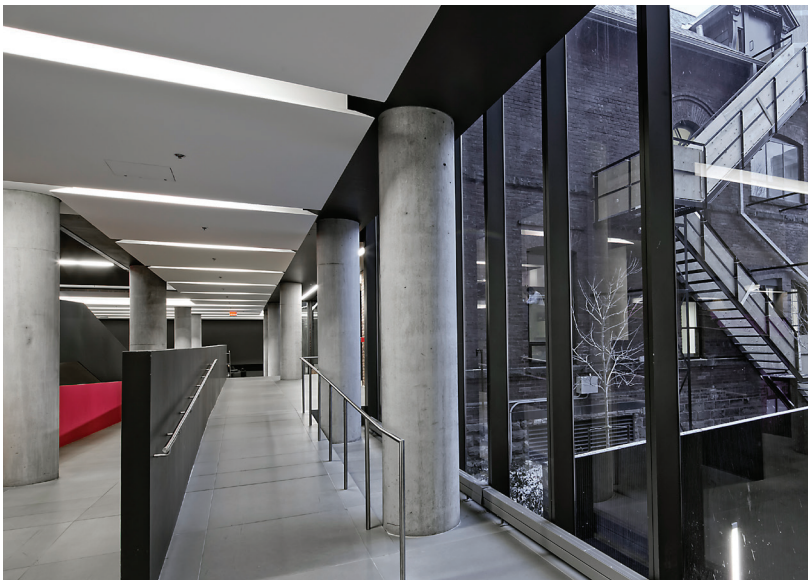
ENVIRONMENTAL BENEFITS

The new facility is designed to be environmentally-friendly and sustainable, and will be certified under the Leadership in Energy and Environmental Design (LEED®) Green Building Rating System.

By incorporating low-flow plumbing fixtures, the facility benefits from water savings throughout the year. Rain water is collected through control-flow roof drains and captured in a storm water cistern outside the building for reuse in the irrigation system, reducing the dependence on city water and decreasing the load on the city storm system.

The tower incorporates a demand mechanical cooling system consisting of a centralized 100% outdoor air heat recovery unit, compartment units on each floor, for the upper floors and dedicated air handlers capable of 100% outdoors air free cooling when ambient conditions permit on the lower floors. Outdoor air is pre-treated through enthalpy recovery wheels in each air handler and the quantity of outside air processed is varied through a demand control ventilation sequence, both of which reduce the heating and cooling requirements. Fan and pump energy is reduced via variable frequency drives to match the demand of the building.

Some of the other environmentally-friendly features include but not limited to: the lighting for the building and site have been designed to minimize light pollution; building systems and operations that are free of CFC-based and HCFC-based products; enhanced building commissioning practices to ensure that the building is constructed and operated as designed; and the use of materials that emit low amounts of volatile organic compounds (VOCs).



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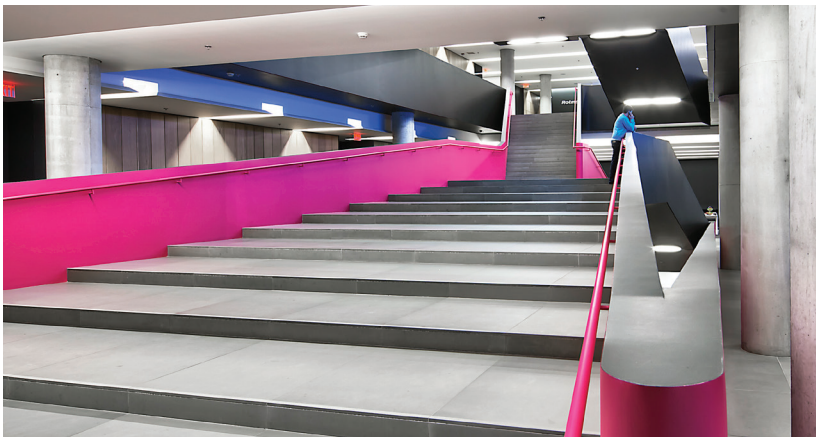
MEETING CLIENT'S NEEDS



The Rotman School of Business experiencing rapid growth was required an additional high performance durable building for specialized lecture, student gathering and areas for internationally renowned research, while providing staff and students with a superb working and learning environment respectively for many years to come. The project needed to be built on time and on budget while maximizing the appeal for prospective students and alumni and minimizing impact on the environment and disruption to the existing facility.

Working as an integrated team, the design produced a building that has been recognized as a marquee location at the University of Toronto St. George Campus and has been revered by many. The team was able to successfully integrate the existing Rotman building and the historic residence building into the design of the facility through the five-storey atrium space and while ensuring adequate space for service and maintenance of the mechanical and electrical systems.

Through the various sustainability initiatives implemented in the design, the University of Toronto was able to meet the reduction targets for energy and water, which ultimately reduced the University's carbon footprint. Finally, exceptional indoor air quality has been provided truly which develops a healthy environment for the University to develop the business leaders of the future.