Engineering Technology Building, McMaster University
Hamilton, Ontario

A university building is unique when students learn from the structure as well as from the instructors.

"The desire to use the building as a teaching tool was established at the outset with this initiative taking several forms," says Chris Harrison from the architectural firm Vermeulen Hind. "The concrete structural frame is exposed throughout the building as a demonstration of structural concrete design and engineering, as well as in the elliptical walls that extend beyond the west façade. In addition [to exposing the structural concrete] we tried to selectively expose other components and systems such as ventilation ductwork. We also tried to feature the metal fabrications -- stairs and secondary framing members -- as examples of innovative structural design."

Beginning this fall, the 125,000 sq. ft. building will house the first year engineering program, the McMaster-Mohawk [College] Bachelor of Technology Partnership, the School of Biomedical Engineering, the McMaster Biointerfaces Institute, and the Walter G. Booth School of Engineering Practice, which includes the Dofasco Centre for Engineering & Public Policy, the GMC Centre for Engineering Design, and the Xerox Centre for Engineering Entrepreneurship & Innovation.

David Wilkinson, Dean of Engineering says the design of the teaching studios with the students in side ellipses and the instructor in the centre gets away from the traditional lecture hall style of teaching. "This makes it more welcoming for [our]first year students. It's designed to fit a more collaborative teaching style, and represents significant expansion [of space] for the Faculty of Engineering. We work closely with the Faculties of Health Science, Business and Social Sciences, which are all engaged with programs in the building, so it has an impact right across campus and moves us forward in many areas of research initiatives."

The five-storey [plus basement] glass-clad building sits impressively next to Main Street on the largest part of campus between the two-storey stone-clad Information Technology building and the McMaster Hospital with its exposed service towers and pre-cast panels.

"There were some unusual materials used including an aluminum curtain wall, natural grey stone, natural finish Douglas Fir ceilings along the ground floor perimeter, grey epoxy floors with DAROtopping beneath, sand coloured architectural block, and acoustic wall panels with natural-finish maple slats," says general contractor Ben Chae from Bird Construction Company. "The oval-shaped exposed concrete wall is half on the interior and half on the exterior from the basement to the floor leaning eight degrees from vertical."

Harrison says the concrete contains varying amounts of granulated slag in order to offset the amount of Portland cement involved, which is a significant contributor to greenhouse gas production. The slag is a by-product of the steel making process, something for which Hamilton is well known.

Construction on the $48m project began in 2007, and was not without its challenges. Having to deal with near-record snowfalls that year required using winter-ready materials ensuring the project did not lose time or money. Work was also slowed and made difficult with the construction of the ellipse wall, says Chae. "We had to use self-levelling, self-consolidating

Agilia concrete because we could not vibrate the concrete due to the amount of rebar in it and due to its tilt, and because of the type of fine-textured finish. Each floor had to be poured in one shot without any construction joints." Other challenges included a high water table and unstable soil conditions. Chae says they compensated for the soft soil by building very large footings to properly stabilize the building.

"This project was originally striving for LEED silver certification, but because of exceptional design and construction performance we could potentially achieve just enough innovation credits for gold certification," Chae says. "There were growing pains when trying to implement and monitor LEED but trades soon realized that it could help their work on site by providing a cleaner, safer and healthier work place while helping the environment at the same time."

By getting materials from local sources as much as possible, using recycled content, using wood from managed FSC certified forests and diverting more than 95 percent of construction waste from landfill, resources were conserved.

Don Brown, Senior Mechanical Designer with Vanderwesten Rutherford Mantecon says "The plumbing is pretty typical for a laboratory / science building; lab air, lab vacuum, natural gas, reverse osmosis water piped to the labs. The unique feature is that the design allows for harvesting of roof water with minimal treatment for use with water closets. With further treatment the water is potable for use in all the sinks, lavatories and drinking fountains in the building."

Structural engineer Dave Douglas says the structure is predominantly comprised of reinforced concrete (columns, walls, slabs and transfer beams), with the mechanical penthouse and feature stairs being framed out of structural steel, all of which were designed by Halcrow Yolles. "As the main thrust of the project was to achieve a LEED Gold Certification, Halcrow Yolles suggested the use of high-volume supplementary cementing materials (HVSCM). These are typically by-products from power stations or steel manufacturing plants that are usually disposed of, but which enable a reduction in the use of manufactured Portland cement. This ultimately contributes to a sustainable initiative by providing a lowering of the carbon dioxide emissions for the materials used in the project and by diverting potential waste from landfill sites," Douglas says.

Harrison says that although most of the applicable LEED points are targeted, the design used an integrated design process focussing on four principal categories -- water usage [mentioned above], energy efficiency, indoor environmental quality and resource stewardship. "Energy efficiency comes from heat recovery in the dual duct ventilation system, which shuts down when spaces are unoccupied. The lighting control system reduces artificial lighting when daylight is available. Indoor environmental quality is enhanced by low VOC emitting finishes in addition to the ventilation and day lighting systems."

This unique building will complement the partially reconfigured John Hopkins Engineering building, says Wilkinson. "It is very visible as people are approaching campus, giving us a refreshing new look. This is part of a long-term concept for a new entrance and a new look for the university."

AWARD Magazine
October 2009