CASE STUDY

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Ontario Cast-In-Place Concrete Development Council

Humber College, Building B

At 83,694 sf., this new three-storey building for Humber College accommodates the student testing centre and new classrooms. It is also the new home for the administration departments including the Presidents' and Vice-Presidents' offices.

Humber College desired an architectural and structural design solution incorporating tilt-up concrete construction, which addressed issues of constructability, durability, and cost considerations along with project schedule requirements.

The key was to establish the perfect balance of the program spaces and the proposed building height, where the use of tilt wall could be easily achieved based on the size of panels for fabrication and ultimately lifting into place. The initial design for the structure combined the use of structural steel framing and steel joists for the interior buildings structure. This system resulted in excessive building heights and excessive tilt-up panel weights to lift. The use of precast concrete core slabs as an alternate flooring structural system reduced the building height and now allowed for a manageable panel to lift. Further, a pattern of exterior envelope panels provided sufficient width to incorporate the glazing with larger sizes. The precast concrete slabs provided the required fireproofing.

The actual site area for the new building was extremely restricted, and the layout of the building footprint had to consider the constructability of the structure over the construction period. The sizes of the panels also had to be considered with the actual footprint of the building, as there was no extra room around the perimeter of the construction site for casting beds. The slab on grade allowed for the forming of the beds. The slab is 125 mm thick and bears on top of 100 mm high strength insulation. The slab was saw cut at the same points that mark each of the panel widths, to avoid the telegraphing of control joints to the panels during the casting process.

The total area of the tilt-wall panels is 41,000 sf. (3,809 m^2) and the average weight of each panel at approximately 150,000 lbs. The average width of each panel is approx

Owner:	Humber Institute of Technology & Advanced Learning
Architect of Record:	Barry-Bryan Associates (1991) Limited Architects, Engineers, Project Managers
Engineer of Record:	Barry-Bryan Associates (1991) Limited Architects, Engineers, Project Managers
General Contractor:	Graham Construction and Engineering, a JV
Material Supplier:	St Marys CBM
Additional Participants:	• Belmont Concrete Finishing • C & T Reinforcing Steel Co. (1987) Limited • Carpenters Local 27 • Dayton Superior Canada Ltd. • Ironworkers Local 721 • National Concrete Accessories • Tilt Wall Ontario Inc.
Project Facts:	• Construction from November 2006 to September 2007 • Three Floors, plus Penthouse • Building Gross Floor Area: 83,694 sf (7,775.4 m^2) • Typical Floor Area: 28,400 sf (2,601 m^2) • Dims: 188.45′ x 139.04′ (57.440 m x 42.380 m) • Height: 42.65′ (13.00 m)

OCCDC

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35′ (10.67 m) and heights at approx. 42.65′ (13.0 m). The panels are of a sandwich type with the interior width at 12″ (300 mm) and left exposed as the final interior finish-with a paint coat), with 4″ (100 mm) rigid insulation and 3″ (75 mm) exterior coloured concrete wythe.

The architectural and structural solutions for design was met by combining the tilt-wall assembly with the precast floors, ie:

1. Temporary bracing of exterior and interior 3-storey panel with conventional bracing and temporary ring beam.
2. Bearing the precast slabs on the tilt-wall.
3. Making sure none of the precast slabs touched the tilt-wall panels (1″ to spare at each end).
4. Integration of interior steel framing with exterior tilt-up panels.

The planning and layout of the building resulted in a 3-bay structural arrangement.

The tilt-up panels (interior or exterior) were initially erected and braced in a conventional manner using two (2) levels of adjustable braces from slab to wall. Continuous perimeter HSS bearing beams were installed to provide support and additional panel stability. These perimeter 'ring' beams were connected to interior tilt panels and/or structural steel framing with horizontal struts. Temporary construction loads could then be transferred to bracing in the adjacent bays.

This allowed conventional braces to be removed to accommodate the precast concrete floor installation. The precast floor sections were carefully installed using skilled workers and a skilled crane operator.

The entire assembly with the use of concrete for the insulated concrete floor slab, the concrete exposed walls on the interior side, and the exposed precast roof deck, enabled the use of a modified heating and cooling system, where the use of the 'Termodeck' system employs the thermal mass properties of concrete, to significantly reduce the consumption of power and fuels.

With the exposed concrete on all the interior sides of the building, and the insulation on the exterior side, the building acts as a thermos, for heating or cooling. Sizing of base building HVAC were substantially reduced using the sustainable 'Termodeck' concrete system.

The largest use of "concrete expression" that extends beyond the building face, was the use of a tilt wall slab that is hung and cantilevered (in a mortise and tenon manner) onto the concrete wall below, immediately above the main building entry. This form of concrete acts a starting point or foundation for the embodied architectural narrative i.e. what the building "means" within the Humber College context for learning, work, or community involvement.

2008 Ontario Concrete Award winning project for Structural Design Innovation

In 2000, the Ontario Cast-In-Place Concrete Development Council (OCCDC) was formed to aid the owner/developer, architect/engineer and design-build contractor in the decision-making process of choosing the best construction material for the framing system of new cast-in-place structures.

OCCDC promotes the benefits of reinforced concrete as the construction material of choice based upon the following advantages:

- fast-track construction
- costs savings
- structural advantages
- environmental considerations
- local economy benefits

The Members of the OCCDC incude (alphabetical order):

Aluma Systems Inc.
Carpenters District Council of Ontario
Concrete Forming Association of Ontario
Ironworkers District Council of Ontario
LIUNA–Ontario Provincial District Council
Ontario Formwork Association
PERI Formwork Systems Inc.
Ready Mixed Concrete Association of Ontario
Reinforcing Steel Institute of Ontario

OCCDC

365 Brunel Road, Unit #3
Mississauga, Ontario L4Z 1Z5
Tel: 905-507-1122
Fax: 905-890-8122
Email: buildings@occdc.org

www.occdc.org