CASE STUDY

VOLUME 10, ISSUE 4

Ontario Cast-In-Place Concrete Development Council

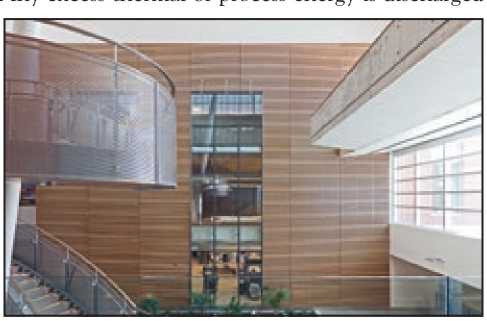
Canmet Materials Technology Laboratory

Natural Resources Canada has relocated its CANMET Materials Technology Laboratory from Ottawa to Hamilton to be closer to the steel and manufacturing sectors it serves through metallurgical research and testing. Located on Longwood Road South, CANMET is the anchor tenant for McMaster Innovation Park. Operational since November 2010, this 3-storey, 174,300-sq-ft building incorporates a state-of-the-art industrial lab program designed to foster relationships between government, academic research and industry.

With aspirations to be a world class lab building which is leading edge, easily managed and built with an effective use of funds, it is the sustainable design objective for a LEED Platinum target that set the stage for CANMET to be a precedent showcase building for sustainable design and triggered an intensive comprehensive Integrated Design Process. This process brought stakeholder representatives from McMaster Innovation Park and CANMET, a facilitator from National Resources Canada and the consultant team to the table on a bi-weekly basis throughout the design phase. The IDP process was pivotal to soliciting collective buy-in, determining building massing and the combination of sustainable design strategies implemented. A resulting Building Charter included enhancing the energy performance target to meet the 2030 Challenge which sets the target for new and renovated buildings at a minimum 60% energy reduction from 2010 to 2015, a goal that is particularly challenging for industrial lab buildings. Combined with a commitment to an elegant design resolution that embraces and integrates sustainable design measures and lab processes, underscores the holistic approach for a fully inter-connected building where design and functional systems work in tandem.

The design team sought ways to maximize performance of each strategy, a process that ultimately shaped the building. Fundamental to passive strategies for energy reduction is a high-performance thermal envelope for walls, foundations, roof and triple glazing. Orientation of the long axis on the south and north side offers more readily harvested daylight and thermal control through orientation specific solar shading and glazing selections. And with a large roof surface to exploit, the building was primed to take full advantage of solar energy-sourcing. Daylight and occupancy sensors automatically phase lighting and blinds to reduce electrical energy use.

The guiding principle to the mechanical, electrical, and renewable systems is maximized energy efficiency and waste reduction. The vast roof above this three-storey structure allowed for extensive renewable source installations, including 209 solar thermal collectors to harvest heat. Thermal energy, collected in solar tanks within the penthouse, operates year round and is used for radiant and domestic water heating. Collectively, the tanks have 40,000 gallons of hot water storage capacity, which equates to 3 days heating for the building. Any excess thermal or process energy is discharged to the 152m deep, 80-borehole, ground source system located in the plaza to the north of the building. Cooling is supplied by the borehole field.



Both the radiant heating and cooling piping are buried in the thermal mass of the concrete ceiling slabs. In most slab locations, in order to increase the available

Owner: McMaster Innovation Park

Architect of Record: Diamond Schmitt Architects

Engineer of Record: Read Jones Christoffersen Ltd.

General Contractor: EllisDon Corporation

Forming Contractor: RES 2000 Structures Inc.

Material Supplier: St. Marys CBM

Additional Participants:
- Aercoustics
- A.J. Clarke and Associates ltd.
- Aluma Systems Inc.
- Carpenters Local 18
- CFMS West Consulting Inc.
- Cobalt Engineering
- Engineering Harmonics Inc.
- G & A Masonry
- GSP Group Inc.
- Interior Decorhaus
- LIUNA Local 837
- Natural Resources Canada
- Salit Steel
- Structural Floor Finishing

Project Facts:
- Located in Hamilton, Ontario
- Completed January 2011
- Building gross floor area 16,196m^2
- Total construction time was 76 weeks
- Concrete volume 11,375m^3
- LEED target – Platinum registered, local materials

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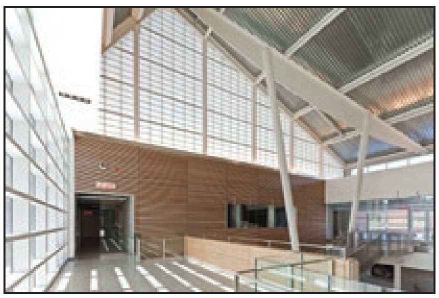
thermal mass and create a flat exposed ceiling plane, drop panels were replaced by thickening the slab. To reduce condensation issues, the radiant system is run at moderate temperatures in winter and summer, respectively. The extensive use of exposed concrete in the structure also aids in the passive heating strategy incorporated into the building design. South facing glazing is shaded on the exterior by overhangs and sunscreens to eliminate direct solar penetration in the summer, but allow the sunlight to enter in the winter months where its heat can be transferred to the structure. In combination with the high-performance thermal envelope, this provides CANMET with very stable interior temperatures.



The building is charged with 100 percent fresh ventilation air, which is decoupled from the heating and cooling system to harness further efficiencies. This air is delivered through access floors or low-level diffusers throughout the facility. Ventilation pre-heat is provided by a 7,590 sf low-tech solar wall. The solar wall has already shown the ability to increase incoming air by 16°C on a typical day in January. Tilted to 52° to optimize heat collection this wall doubles as a roof/wall to the penthouse.

Current modeling has resulted in a greater than 70% energy cost reduction compared to MNECB. The projected annual electrical energy consumption is 724_ MJ/m^2. Renewable energy measures are anticipated to contribute a 7.5% energy cost reduction.

The industrial radiography section of the non-destructive testing facility within the building makes use of concrete as radiation shielding. In order to minimize lead shielding for the X-ray and radioisotope labs, the concrete thicknesses were increased substantially based on calculations by a nuclear engineer using standard density concrete as the only shielding material. Penetration for ducts, pipes and other services required lead shielded doglegs, but essentially all the major shielding is composed of cast-in place concrete, up to one metre thick in some areas. The electron microscope facility, which has six separate instruments with a variety of magnification resolutions, made use of 1.5m thick isolated concrete pads under each unit to mitigate the effects of traffic vibration from the adjacent street. In the high bay metal casting lab a large portion of the floor was depressed and then filled with a 100mm thick specially formulated refractory cement based topping that resists fracturing from thermal shock from molten metal splashes.

2012 Ontario Concrete Award Winning Project Institutional Building

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