Innovative Temperature Control Methods

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SUMMARY

Kleinfeldt Mychajlowycz Architects's (KMA's) design of the Greater Toronto Airport Authority's (GTAA's) new Fire and Emergency Services Training Institute (FESTI) achieved Leadership in Energy and Environmental Design (LEED®) Silver certification. Noteworthy to the building are two innovative heating and cooling mechanisms that maintain high air quality and are cost efficient.

STRIVING FOR LEED CERTIFICATION

The completed project—comprising the school, administration offices, apparatus and vehicle bays, and three training structures on Toronto Pearson International Airport's property—achieved LEED Silver rating.

Every design project has elements that require added attention for the FESTI project scale; massing layout, exterior finishes, and daylighting were high priorities. Critical to the design was the buildings' orientation on the site with consideration to passing air traffic. As well, sustainable design and LEED criteria required innovative design decisions and created layers of programmatic depth that were met through solar shading, a green roof, solar wall construction, and natural ventilation.

INNOVATIVE MATERIALS

The FESTI building incorporates two innovative and sustainable tools for heating and cooling, SolarWall® and TermoDeck®. Both methods are cost effective and energy efficient.

The southwestern façade is clad with SolarWall technology, a simple assembly of perforated metal siding with a conductive black finish. The cavity between the perforated siding and the sheet metal liner traps air, which is then heated by the energy captured by the black finish. The force of convection either feeds the heated air into the building's air-handling system through a simple plenum and fan used for heating or directed away from the exterior wall with dampers contributing to cooling.

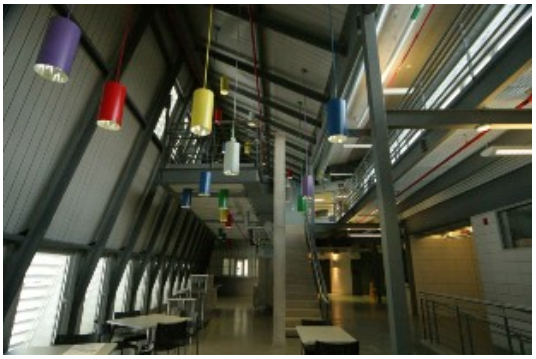
This simple yet effective innovation of preheating exterior intake air reduces annual heating costs by $2–8 per square foot of the collector and delivers annual CO^2 savings of one ton per five square meters of collector, while its cost is comparable to that of a brick wall.

Natural ventilation, a key design component of the building, contributes to the improved efficiency in heating and cooling, as well as providing a more comfortable and healthier environment for the Institute's staff, students, and visitors. Other architectural elements, such as a second-story courtyard, double-wall stack, exterior solar shades, volume articulation, and operable windows minimize stale air in the building and promote constant air circulation.

At the heart of the building's heating, ventilation, and air conditioning (HVAC) system is the TermoDeck radiant heating and cooling system, originating in Sweden. As opposed to conventional forced air-systems, TermoDeck is a low-pressure system that uses hollow-core concrete slabs to distribute air that takes advantage of the building's thermal mass to heat and cool the air. On the ground floor, the same channeling of air through the poured-floor slab

recreates the TermoDeck thermal mass effect. With TermoDeck radiant heating and cooling accounts for upwards of 70 percent of room temperature control; this system heats or cools the occupants directly, rather than the air around them, with the stored thermal mass not conditioned air.

This is an extremely efficient system, continuously monitored by computer sensors that direct the flow of heated or cooled air to each room and increase the flow of fresh air to occupied rooms by reading CO^2 level fluctuations. With the exception of extreme temperatures, the TermoDeck system uses 100 percent fresh air, whereas conventional systems can use as little as 10–15 percent. The result is a constant temperature in the building without the introduction of blasts of hot or cold air that occur in normal forced-air systems and circulation of air with a higher oxygen content.



By focusing on providing the best possible environment for the building's occupants and general community and committing to responsible building practices, the GTAA has provided a healthier space for its trainees and staff. Its FESTI facility is an example of how simple building innovations such as ThermoDeck and the SolarWall can be used to create an environmentally sound building and at the same time enhance its architectural design.

About the Contributor

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RESOURCES

More Best Practices

The following AIA Best Practices provide additional information related to this topic:

16.02.08 Steps Toward LEED Certification

16.01.02 Green Roof Design

16.02.09 Energy Modeling and Daylighting Analysis

For More Information on This Topic

See also "Selecting Environmentally Preferable Products" by Nadav Malin, LEED AP, *The Architect's Handbook of Professional Practice, 13th edition, Update 2005*, page 81.

See also the 14th edition of the *Handbook*, which can be ordered from the AIA Bookstore by calling 800-242-3837 (option 4) or by email at bookstore@aia.org.

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Key Terms

- Building performance
- Sustainability
- Energy-efficient buildings