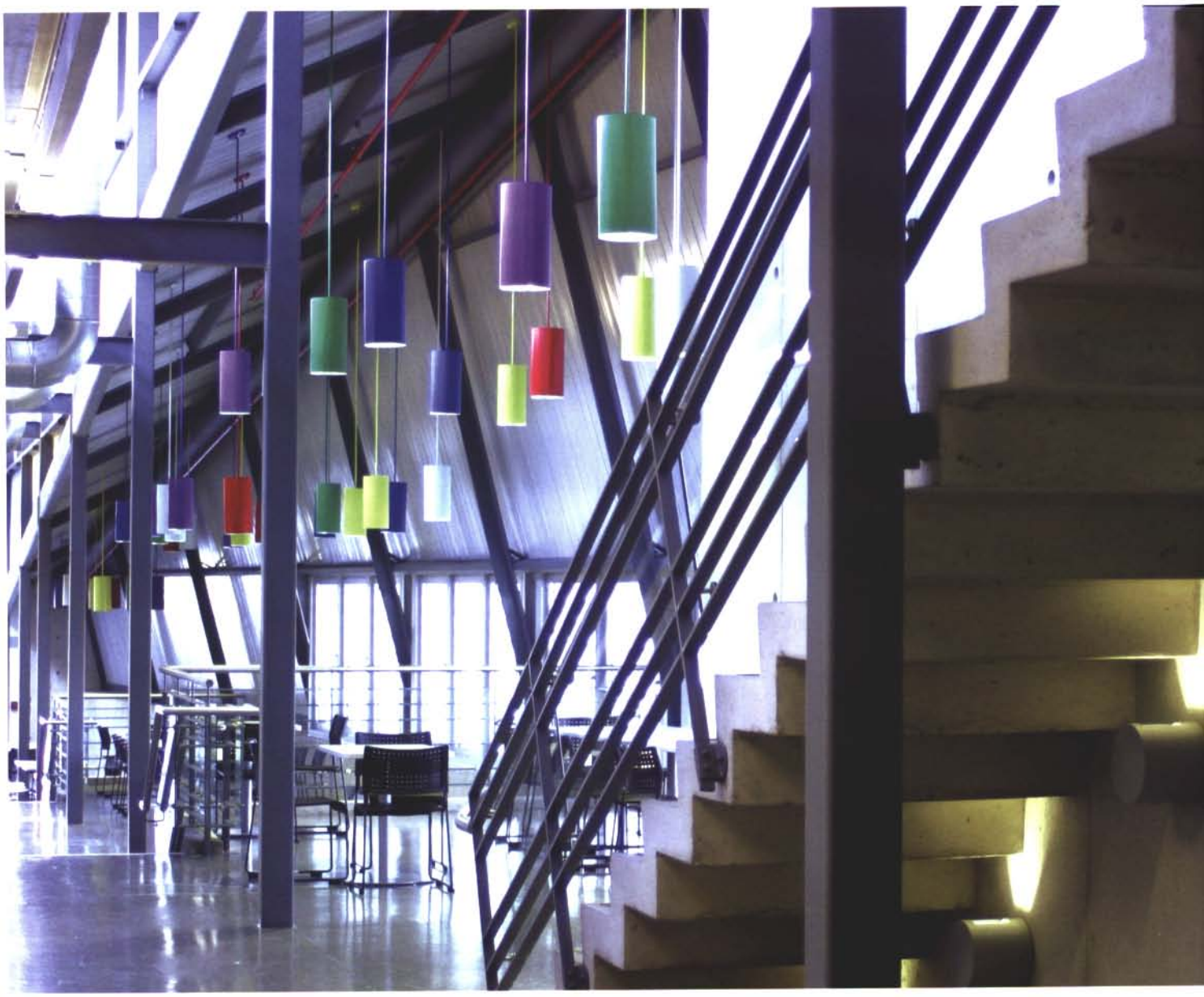
Toronto Fire and Emergency Services Training Institute

State-of-the-art training centre balances passive and active technologies



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CIVIL ENGINEER Trow Consulting Engineers Ltd., Brampton, ON **CONSTRUCTION** Aquicon Construction, Brampton, ON

KASIA MYCHAJLOWYCZ

When the Greater Toronto Airport Authority [GTAA] chose to pursue LEED™ Silver certification for the first time on its new Fire and Emergency Services Training Institute [FESTI], it signified a new sense of commitment to sustainable building technology and a willingness to be held accountable to the rigorous design guidelines and third-party certification of the LEED™ process.

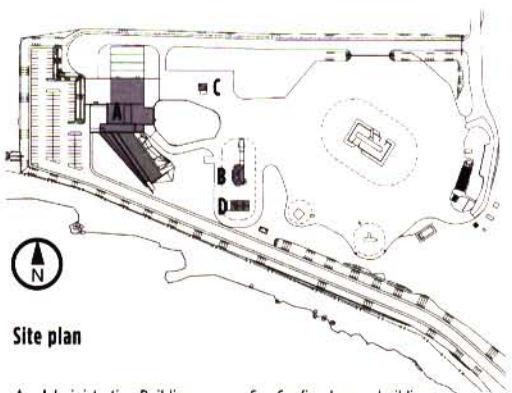
The project, located on Toronto Pearson International Airport property, comprises several functional components: a school, administration offices, apparatus and vehicle bays and three training structures. The building incorporates readily available low and high tech building components to improve not only its environmental and economic performance, but also its functionality and architectural design.

The complex is sited to take advantage of views, access to natural daylight, and exposure to solar radiation and wind. The organization of the Administration/ Education Building developed a strong, figurative and literal "inhabitable wall" that mediates between the rigid geometry of the vehicle bays and the classrooms and cafeteria that terrace toward Etobicoke Creek.

The clarity of the plan and the complexity of the section create dynamic and varied spaces. Careful consideration was given to massing and exterior finishes, and to the placement and character of lighting for day and night response. Lighting was a particularly critical issue given the location of the project adjacent to a runway. Transparency, permeability and solidity are explored for both practical and aesthetic purposes.

Solar shading, a green roof, a solar wall and natural ventilation are identifiable elements of sustainable design that are integrated into the

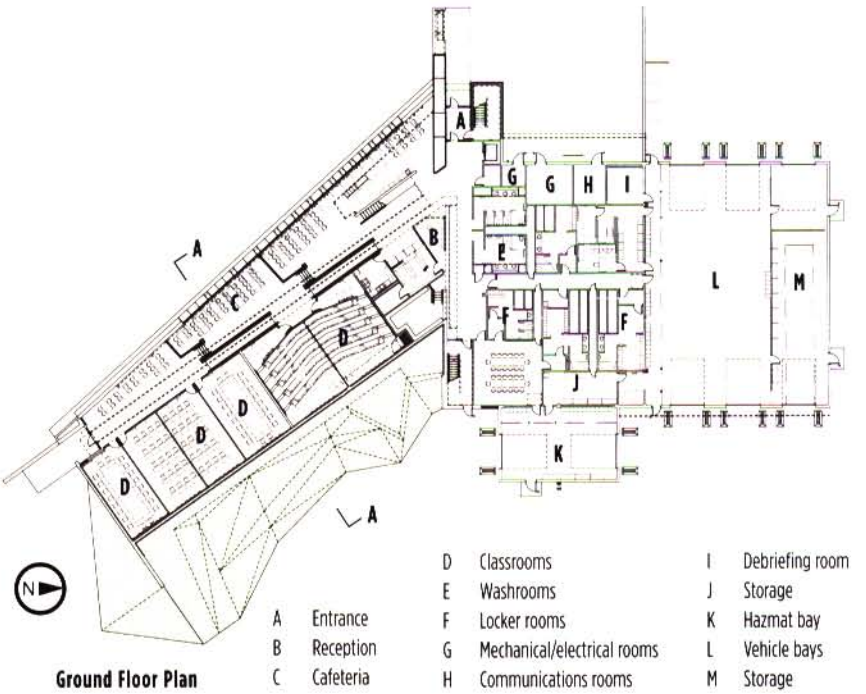
VIEW ALONG THE CAFETERIA SEATING NEXT TO THE SOUTH- WEST FACING WALL. THE EXPOSED POLISHED CONCRETE FLOOR AND STEEL FRAMING FULLY EXPRESS THE STRUCTURE [1]. THE EAST ELEVATION WHERE VEHICLE BAYS AND BERMED EARTH ACT AS THERMAL BUFFERS AND REDUCE PERIMETER WALL EXPOSURE [2].



Site plan

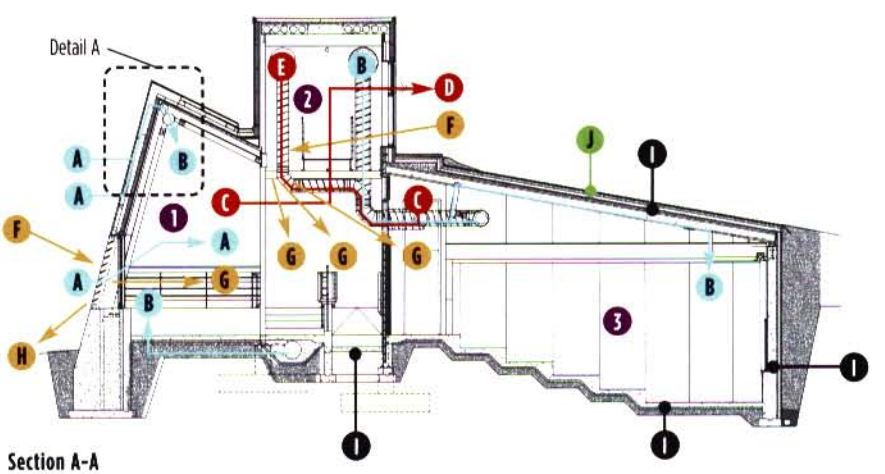
A Administration Building
B Burn Buildig
C Confined space building
D Rescue Tower

TRANSLUCENT GLAZINGS, WITH A LIGHT-COLOURED EXTERIOR FINISH TO REFLECT HEAT, PROVIDE DAYTIME ILLUMINATION OF THE SOUTH-FACING STAIRWELLS [3].



Ground Floor Plan

A	Entrance	D	Classrooms	I	Debriefing room
B	Reception	E	Washrooms	J	Storage
C	Cafeteria	F	Locker rooms	K	Hazmat bay
		G	Mechanical/electrical rooms	L	Vehicle bays
		H	Communications rooms	M	Storage



Section A-A

1	Cafeteria	C	Warm interior air	H	Shading device
2	Catwalk 1	D	Stack effect ventilation	I	Concrete structure thermal mass
3	Classroom	E	Return air	J	Green roof
A	Fresh air from outside	F	Daylight		
B	Supply air	G	Reflected daylight		

architectural expression. The green roof that extends from the upper catwalk of the cafeteria to the ground connects the building both physically and visually to its surroundings, while elsewhere heat reflective roofing and perforated siding contribute further to the architectural and ecological language of the building.

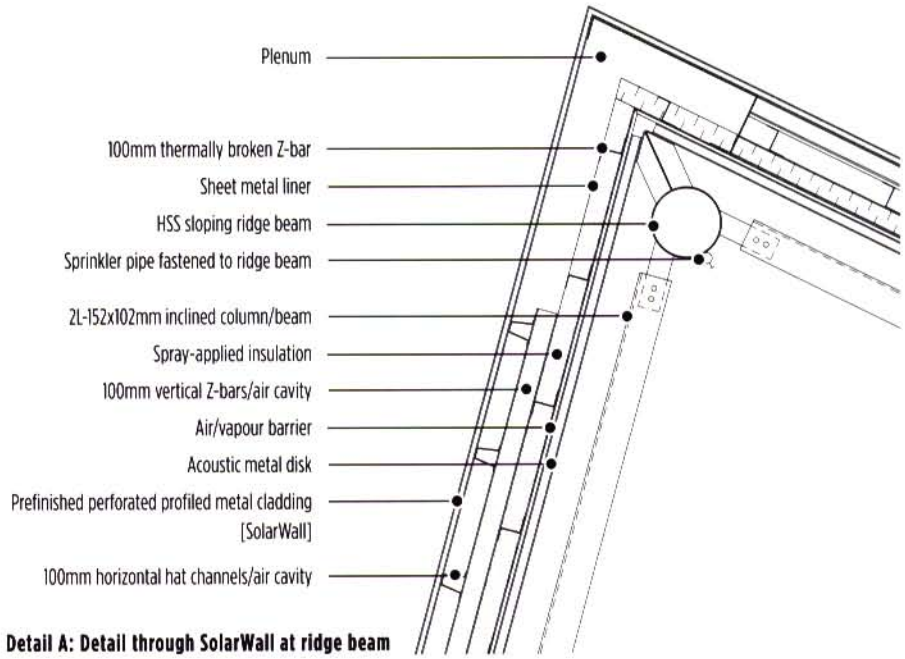
The south-western facade is clad with SolarWall®, a simple assembly of perforated metal siding with a conductive black finish. Air trapped between the perforated siding and the sheet metal liner is heated by the energy captured by the black surface. When heating is required, the convective forces feed the heated air into a plenum where a fan delivers it to the building's air handling system. When heating is not required, dampers open to direct the warm air away from the building.

This simple innovation reduces annual heating costs by $20 to $80 per square metre of the collector, and reduces annual CO_2 emissions by 1 ton per 5 square meters of collector. Construction cost for the system is comparable to that of a brick wall.

Natural ventilation contributes further to the efficiency in heating and cooling, as well as providing a more comfortable and healthier indoor environment. Other architectural elements, such as a second-storey courtyard, double-wall stack effect ventilation, exterior solar shades, volumetric articulation and operable windows minimize stale air in the building and promote constant air circulation.

Primary heating and cooling is provided by a TermoDeck® radiant slab system. As opposed to conventional forced air systems, TermoDeck® is a low-pressure system that uses hollow core concrete slabs to distribute air taking advantage of the thermal mass of the building for conditioning the air.

On the ground floor, the in-situ concrete slab replicates the hollow cores of the TermoDeck® upper floors. Up to 70% of the heating or cooling of rooms is through the radiant effect, directly heating or cooling the occupants rather than the air around them.



Detail A: Detail through SolarWall at ridge beam

MATERIALS

- Poured in place concrete and pre-cast stairs and tilt-up sections, steel structure with SolarWall® steel cladding at south elevation; linoleum epoxy flooring; spray-applied insulation; Lexcan TPO reflective roofing, ELT green roof; heat recovery ventilator captures heat from building exhaust air, tankless water heaters,
- Kalwall insulated translucent glazings, PPG Solar Ban 60 glazing, exterior sun shading at windows; low-flow toilets and fixtures, and waterless urinals
- Area: 30,000sf

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 fluctuations in CO_2 levels. With the exception of extreme temperatures, the TermoDeck® system uses 100% fresh air, whereas conventional systems can use as little as 10% to 15%.

By committing to responsible building practices, the GTAA has created a healthier space for its trainees and staff, and an energy efficient building that benefits the surrounding community. The FESTI facility illustrates how simple and inexpensive design innovations can contribute to an environmentally sound building and at the same time enhance its architectural expression.◄

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VIEW FROM INSIDE THE CAFETERIA. THE PROPRIETARY TERMODECK SYSTEM PROVIDES MAIN HEATING AND COOLING USING FRESH AIR THAT IS CONDITIONED AS IT FLOWS THROUGH HOLLOW CORE CONCRETE CEILING SLABS [4]. THE SOUTH-WESTERN FACADE CLAD WITH SOLARWALL®, A SIMPLE ASSEMBLY OF PERFORATED METAL SIDING WITH A CONDUCTIVE BLACK FINISH, A LOW-TECH WAY TO PREHEAT INCOMING AIR IN WHICH THE SUN HEATS AIR TRAPPED BETWEEN THE BLACK, PERFORATED SIDING AND THE SHEET METAL LINER BEFORE IT ENTERS THE BUILDING [5]. THE GREEN ROOF ALONG THE EAST ELEVATION EXTENDS FROM THE UPPER CATWALK OF THE CAFETERIA TO THE GROUND, CONNECTING THE BUILDING BOTH PHYSICALLY AND VISUALLY TO ITS SURROUNDINGS [6].