OCCDC

case study

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Ontario Cast-In-Place Concrete Development Council

Earth Rangers Wildlife Centre

Located in Woodbridge, Ontario, the Earth Rangers Wildlife Centre is an environmentally advanced building serving as a wildlife rehabilitation, education, and research centre. This 5,800 m^2 centre is a best-in-class veterinarian hospital, and is Canada's only oil spill response unit dedicated to wildlife. It also provides an interactive education program. Building areas include a veterinary hospital, wildlife rehabilitation rooms, seminar/demonstration rooms, feed preparation and service rooms, animal care facilities and educational areas.

Summaries of the building's significant features are:

- Well insulated concrete slabs, walls, and roof
- Ventilation heat recovery on all air handling systems
- Locally sourced materials, recycled building materials
- Radiant heating, natural cooling, concrete "earth tube" technology to temper make-up air
- Rainwater harvesting, on-site wastewater treatment
- Domestic hot water heating by roof mounted solar panels
- Energy efficient lighting design
- "Green" vegetated roof

The building structure is reinforced concrete with load bearing masonry walls in the animal areas to provide a durable, moisture resistant interior surface. All insulation is on the building exterior, so that approximately 4,000 m^3 of concrete is on the interior, conditioned side of the insulation. This enables the large mass of the concrete and masonry to act as thermal storage and improve the comfort and energy performance of the building.

Radiant Slabs

All space heating and cooling is provided by the 3,400 m^2 of exposed concrete slabs with embedded polyethylene tubing carrying chilled or heated water. This concept of "structural slab radiant cooling" or "thermally activated radiant slabs" uses the slabs both for space conditioning and for thermal storage.

Thermal Storage

Cooled slabs benefit from the large mass of concrete, which is actively cooled by the circulating water. Thermal cooling storage allows a building to offset the time when a cooling load is experienced and when it is rejected from the building. The required peak cooling capacity is also reduced. The design intent here is to cool the slabs to about 18°C overnight using cooling tower water then allow them to warm up to 22°C during the day as they absorb heat from the space. This represents heat storage of 1740 kWh (500 Ton-hours), enough to provide much of the cooling energy on a design day. Since a low-energy consuming cooling tower rather than the electric chiller can provide this energy, there is a

Owner: The Earth Rangers Foundation

Architect: M. Architecture Inc.

Project Manager: Husky Injection Molding Systems Ltd.

Mechanical and Environmental Consultant: Enermodal Engineering Ltd.

Construction Manager: Internorth Construction Company Inc.

Structural Consultant: Internorth Engineering Inc.

Energy Consultant: Transsolar Energieteknik

Formwork Contractor: Hardrock Forming

Design Consultant: Bautech

Concrete Supplier: Dufferin Concrete

Reinforcing Steel: Harris Rebar

Additional Participants:

- Hanson Pipe & Products
- Unilock – Eco Loc Pavers
- Atlas Block
- Carpenters Local 27
- LIUNA Local 506
- Ironworkers Local 721

Project Facts:

- 5800 m^2 structural concrete building
- Located at the Kortright Centre for Conservation north of Toronto
- Construction commenced in September 2002; completed in February 2004
- Exposed structural concrete slabs with embedded polyethylene tubing provide 100% of the space cooling and heating and act as thermal storage during the cooling season.
- 9 - 20 m long concrete underground ventilation tunnels and a double foundation wall temper all outside air for ventilating the building – 15,000 cfm
- 310,000 litre cast-in-place reservoir collects rainwater and treated sanitary wastewater for re-use in the building
- Annual energy use is calculated to be 63% less than required by the Canadian energy code.

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substantial reduction in electricity use, as well as a reduction in the size of the chiller plant.

Concrete columns and masonry walls are also left exposed as much as possible to give additional thermal mass and stable indoor temperatures. However, in cooling season, temperatures will be allowed to drift during the day to minimize load on the heating/cooling plant and allow heat transfer between the space and the structure.

Dehumidification

Dehumidification at this building is provided by liquid desiccant, chilled water coil and enthalpy heat-and-moisture recovery wheel. The Wildlife Centre is perhaps the largest application in a warm humid environment in North America where the slab provides 100% of the space sensible cooling, and is the first known installation in sloped cathedral roof slabs.

Ventilation Tunnels and Double Foundation

Air supplied to spaces is 100% outside air; there is no recirculation. Supplementing the heat recovery ventilation system in the air-handling units is an underground air inlet structure of precast concrete pipes and a double foundation wall plenum, designed for ground-to-air heat exchange.

Rainwater/ Wastewater Cisterns

A 310,000 litre cast-in-place concrete underground cistern will collect rainwater from the roof and treated sanitary effluent from the high performance membrane treatment system. Already required for on-site fire protection water supply, the cistern was enlarged by 25,000 litres to provide a reserve of non-potable water for toilet flushing, cage cleaning and filling animal ponds. The concrete tank did not require any special liner or surface coating for these applications, and helps reduce well water consumption by 60%.

Flat portions of the roof are finished with a vegetated "Green Roof" for storm water improvement and landscaping. The concrete roof supports the 150 kg/m^2 (30 psf) design load of the soil and vegetation.

Energy And Environmental Performance

As modeled with NRCan's EE4 software for energy simulation, the Earth Rangers Wildilfe Centre will use 63% less energy than a reference building just meeting the MNECB energy code. The Wildlife Center has been submitted to the Canadian Green Building Council for a LEED GOLD rating for sustainable design.

2005 Ontario Concrete Award winning project for Sustainable Concrete Construction

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

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