Hollowcore: “The Fastest Floor in Town”

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INSTITUT CANADIEN DU BÉTON PRÉFABRIQUÉ ET PRÉCONTRAINT
Precast concrete is manufactured off-site in a plant under controlled conditions. This ensures high quality, and quick on-site installation.
What is Prestressed Concrete?

Prestressed concrete has its reinforcement under tension.
When prestressed strands are cut, inducing a compression force in to the member - this is the real advantage of the systems
Precast/Prestressed Concrete Manufacturing

- 7-Wire Strand
- Long-Line Casting Beds
- Permanent Steel Forms
- Admixtures
- High Early-Strength Concrete
- Accelerated Curing
What Are Hollow Core Slabs?

Continuous voids are formed throughout each unit to reduce weight and improve performance.
Prestressing
Sample Hollowcore Load Tables

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<th># of 1/2&quot; Ø strands</th>
<th>Mu (lb ft)</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
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**Coreslab 8 Inch Imperial Load Table**

**Simple Span - Centre to Centre of Bearing - Feet**

Span: 25 feet
Live Load: 100 psf
Dead load: 20 psf
Total Superimposed load: 120 psf
Strands required: 5
Hollowcore on Masonry
Hollowcore on Poured Concrete
Hollowcore on ICF
Hollowcore on Structural Steel
Hollowcore on Wood
Hollowcore on Steel Studs
Hollowcore on Precast
Hoisting Hollowcore...

...with a crane

...with a forklift
Installation
Typical Tie Bar
Anti-Rotation Bars
Holes And Openings
Using The Cores

[Image of a ceiling with a round hole and electrical wiring]

[Diagram of a hollow core system with air temperature indicators: 14°C supply, 19-20°C return, 20-25°C surface]

[Image of a ceiling with a light fixture]
Hollowcore for Radiant Ceilings

- Mechanical options: RAIC + EXHAUST AIR RECOVERY + DEMAND CONTROL VENTILATION + VARIABLE SPEED DRIVES

- Approximately 30% of the energy delivered to buildings is dissipated in the departing ventilation and exhaust air streams.

- RAIC captures part of the daytime ventilation heat for nighttime flushing and with energy recovery, it can operate in 100% fresh air or demand-controlled ventilation mode in extreme heat.

- Hollowcore for Radiant Ceilings
  - PRECAST HOLLOW CORE PLANKS ABOVE LAB SPACES IN NORTH BUILDING
  - AIR DIFFUSER VENTILATES AIR INTO ROOM
  - SUPPLY AIR DISTRIBUTED THROUGH HOLLOW CORES
  - SUPPLY TRUNK DUCT
Ducts

- From the mechanical room, **supply air ducts** run through vertical shafts in the center parts of the building.

- **Distribution ducts** run perpendicular to the length axis of the hollow core slabs above the suspended ceiling in the corridor area.
Diffusers

Using a radiant air conditioning system offers flexibility regarding choice of room supply air system and diffusers.

Any standard ceiling or floor air diffusers can be used.
Typical Connections

Connection to the Slab
Balancing Damper (Typical)
Radiant Air Conditioning Principles

Thermal storage works intuitively with a fan assisted ventilation system. As air passes along the ducts the concrete warms or cools the fresh air before supplying it to the occupied space.

Image Courtesy of Setpoint Building Automation
Lean Thermal Storage

Up to 45% smaller Heating/Cooling Equipment have been linked with concrete hollow core slabs
Mundy’s Bay Elementary School

- LEED Gold-Certified elementary school located in Midland, Ontario, that utilizes a radiant air conditioning system
- ‘Top of the Class’ in Enerlife’s survey of Best Performing Schools in North America and sets a new standard in environmentally-conscious school construction
Mundy’s Bay Elementary School

Based on a gross floor area of 4,792 m², the annualized energy intensity for the school is 138 ekWh/m² or 12.8 ekWh/sq.ft, which is approximately 40% lower than comparable educational buildings in Ontario.
This report summarizes the energy consumption and utility cost savings for the Midland 6th Street elementary school from September 1, 2008, through November 30, 2008.
Westwind Elementary School, Stittsville ON

ARCHITECTS: ema Architects Inc - Ottawa, Ontario
ENERGY CONSULTANTS: Termobuild, Toronto, Ontario
STRUCTURAL CONSULTANTS: Cunliffe & Associates, Ottawa, Ontario
CONSTRUCTION MANAGER: McDonald Brothers Construction, Ottawa, Ontario
GENERAL CONTRACTOR: McDonald Brothers Construction, Ottawa, Ontario
PRECAST FABRICATOR: CORESLAB Structures, Dundas, Ontario
Westwind Elementary School

2 storey, 4600 sq. m. Junior Kindergarten to Grade 6 elementary school with a capacity for 600 students.
Westwind Elementary School

Robert Matthers of ema Architects: “The novel approach to design and construction that was used was conceived to shorten the construction time-frame and to reduce the capital expenditure while improving the building environment and lowering the operating costs.”
ADVANTAGES of Hollowcore

- In-plant quality control.
- Non-toxic.
- Energy efficient.
- All-weather construction.
- Speed – install 650 – 930 square metres (7,000 – 10,000 SF) per day.
- Cores used for wiring, heating, air conditioning.
- Minimum vibration.
- Low maintenance.
- Cost Efficient (reduced insurance premiums).
- Minimal thickness.
- Applicable to most types of framing.
- Immediate working platform.
- No floor squeaks.

Other advantages are...
Bottom of Slabs = FINISHED CEILING
Long Clear Spans

Up to 16 m (50 ft)
High Strength & Durability
Sound Proof  (STC rating of 50)
Fire Safe (2 hour fire rating)
How do the Slabs Achieve a Two Hour Fire Rating?

Hollowcore slabs achieve a 2-hour fire resistance rating by meeting the following requirements in the Supplement to the Ontario Building Code of Canada (Chapter 2):

1. The equivalent thickness of the slab calculated as described in Subsection 1.6 is 125mm for 8” thick Hollowcore. OBC requires a minimum thickness of 124mm as listed in Table 2.2.1.A forming part of sentence 2.2.1 (1).

2. The concrete cover over the reinforcement is 39mm. OBC requires a minimum cover of 39mm as listed in Table 2.2.1.B forming part of sentence 2.2.1 (2).
Types of Applications For Hollowcore

Restaurants
Churches
Long Term Care Facilities
Medical Buildings
Arenas & Stadiums
Car Dealerships
Educational Facilities
Hotels
Residences
Wineries
CPCI has introduced an updated audit based process certification program to ensure conformance to **CSA A23.4** and related standards.

**What Does This Mean?**

1) Improved **quality**.
2) Increased plant **performance**.
3) Better **qualified personnel**.

**How Is This Achieved?**

1) Minimum **2 annual audits**.
2) **Rating system** provided for the entire design, manufacturing and erection process.
3) **80% passing rate** required.
4) Insurance that the minimum industry standards for **quality** are met.

For more information visit:  [www.precastcertification.ca](http://www.precastcertification.ca)
Hollowcore and LEED™

Niagara Regional Headquarters
LEED Silver

West Village Student Condominium
LEED Platinum

Brock University Plaza
LEED Silver
Hollowcore and LEED

The use of Hollowcore has many environmental benefits, some of which are: reduced weight (less raw material extraction), efficient span to depth ratio, no waste, can be reused etc.............

Precast concrete components can help achieve LEED certification in a variety of ways:

- recycled content
- thermal mass
- manufacturing location
- no VOC’s
- low on site labour costs
- insignificant on site waste (all of which can be recycled)

CPCI is a member of the CaGBC

www.sustainableprecast.ca
Canadian Precast/Prestressed Concrete Institute (CPCI) officially launched the new Sustainable Plant Program in May, 2012
Program Overview

The CPCI Canadian Precast Concrete Sustainable Plant Program is a program designed to encourage continuous improvement and compliance to environmental and sustainability regulations and standards.
CPCI Sustainable Precast Plant Program

The program is two faceted:

1. **Sustainability** - Tracking and Benchmarking **GWP, TPE and Water Use** in CPCI member Precast Plants
   
   - Software has been developed by **Athena** to calculate the plant environmental key performance indicators: CPCI will track, and benchmark towards continuous improvement

2. **Environmental Compliance** – Tracking and Benchmarking compliance to **dust, water (waste and process)** and noise.
Sample: CO2 eq. by Life Cycle Stage and by Material

CO2e Emissions by Life Cycle Stage (%)

- Raw Materials: 73.2%
- Plant Operations: 21.5%
- Raw Material Transportation: 5.3%

Material Manufacturing & Transportation GWP (%)

- Portland Cement: 74%
- Rebar: 24%
- Coarse Aggregate - natural gravel: 1%
- Other: 1%
The CPCI Sustainable Plant Program

1. Working with our upstream supplier partners

2. Working with our production teams
CPCI Hollowcore Research

University of Manitoba
(Vertical shear capacity)

University of Western ON
(Bond of topping and horizontal shear)