

# Construction Solutions Conference

November 28, 2006



**Cement Association of Canada**  
Association Canadienne du Ciment



# Presentation Outline

- Briefly review drivers of mould in buildings (and why buildings have to be designed right)
- Douglas Bennion – will present a concrete building solution that addresses the issues of mould and moisture in buildings
- I'll conclude with a suggestions on how to mitigate risks, and provide some sources of reliable information

# What We Agree On

- Conflicting and inconclusive information about
  - health effects from exposure to mold
  - clean-up procedures,
  - acceptable indoor air moisture levels and ventilation
- Two issues most experts agree upon
  1. active mold growth should be removed
  2. eliminating excessive moisture is required to stop mold growth
- Molds can grow on cloth, carpet, leather, wood, wallboard, household dust, and on anything that is made of organic material

# Preventing Mold Growth

- The key is to prevent relative humidities adjacent surfaces from rising above 70 percent (Lstiburek, [www.buildingscience.com](http://www.buildingscience.com) )
- Controlled ventilation and source control limit the interior moisture levels
- Where interior moisture levels in cold climates during the heating season are limited to 25 percent relative humidity, relative humidities adjacent to the interior surfaces of exterior walls (for typical insulation levels) fall below 70 percent and mold growth is controlled
- The colder the climate the lower the interior relative humidity necessary to prevent 70 percent relative humidities occurring adjacent interior surfaces of exterior walls

# Legacy of the Chicago Fire



# The Evolution



# Market Conditions

- Energy prices
- Building materials
- Consumer awareness for global warming and sustainable development



# New “Performance Based” Criteria

- Durability
- Occupant Safety and Comfort
- Energy Efficiency
- Life Cycle Cost



# Control of Moisture

- Airborne, wind driven, subterranean
- Exfiltration or infiltration
- Mold growth, rot, insects, etc.



# A Concrete Solution

- Concrete

- passive barriers against air-borne moisture
- no sustainable environment for mold growth

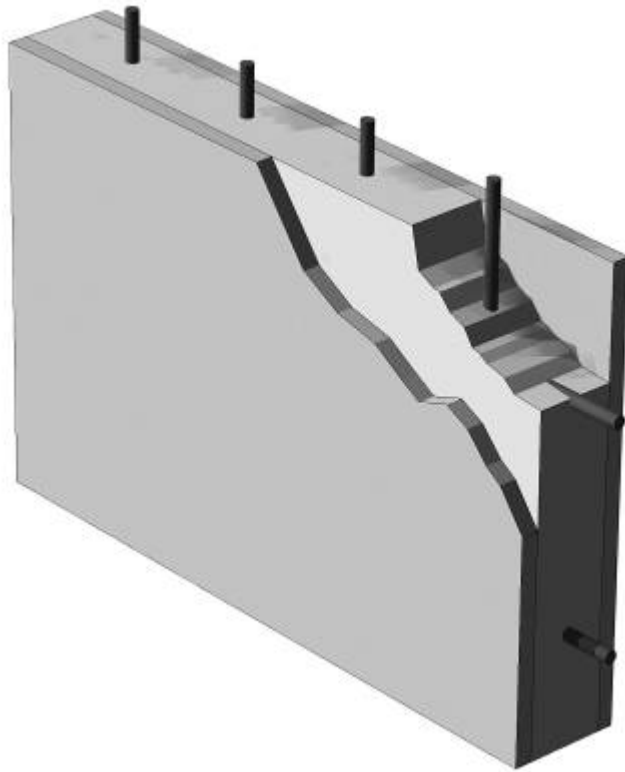


- No oxygen
- No moisture
- No nutrients

# Mold Growth and Wall Design

- Porosity
- Condensation
- Oxygen Supply
- Organic Nutrient Supply

# Mold Growth and Wall Design

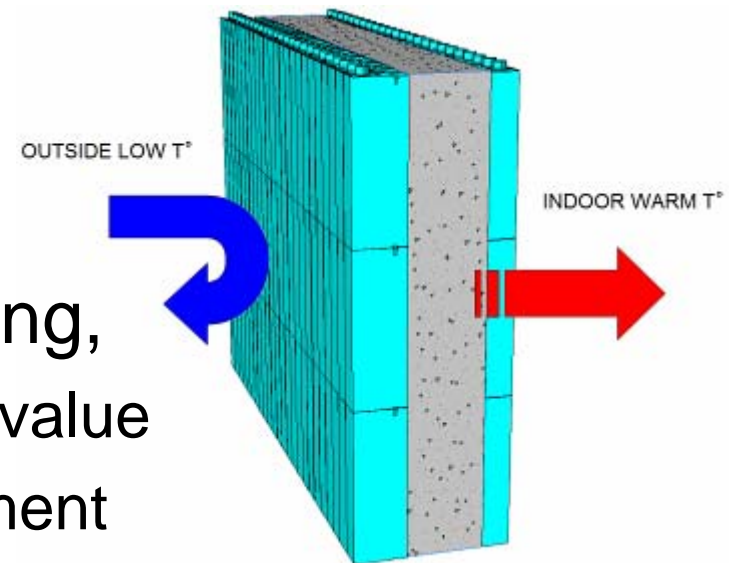


## Porosity

- semi-liquid into a cavity forces all air out
- consolidation via mechanical vibrator eliminates microscopic air bubbles
- Once cured, solid mass with  $\emptyset$  air flow
- Air exchange via equipment, can be conditioned, micro filtered

# Mold Growth and Wall Design

- Porosity
  - Profuse blower door tests at 40 Pa confirm
    - Wood framed cavity walls permit 3-7 complete air changes/hour
    - Insulated concrete structures permit 1-2.5 air changes/hour
      - Mostly door and window openings
- Low porosity = major advantage for heating /cooling,
  - air leakage the nemesis of R-value
  - permits use of smaller equipment



# Mold Growth and Wall Design

- Condensation
  - Insulated concrete walls - no cavity
  - Moisture present at time of construction
    - used in concrete hydration
    - diffusion through insulating layers
  - Low porosity provides no moisture for condensation over long term operation
  - Almost no species survive below RHL of 50%

# Mold Growth and Wall Design

- Oxygen Supply
  - Mold needs oxygen, moisture and cellulose based nutrients
  - No oxygen present to promote growth



# Mold Growth and Wall Design

- Organic Nutrient Supply
  - No organic materials suitable for mold
  - Should cladding fail, nothing on interior wall for moisture or mold to attack or degrade

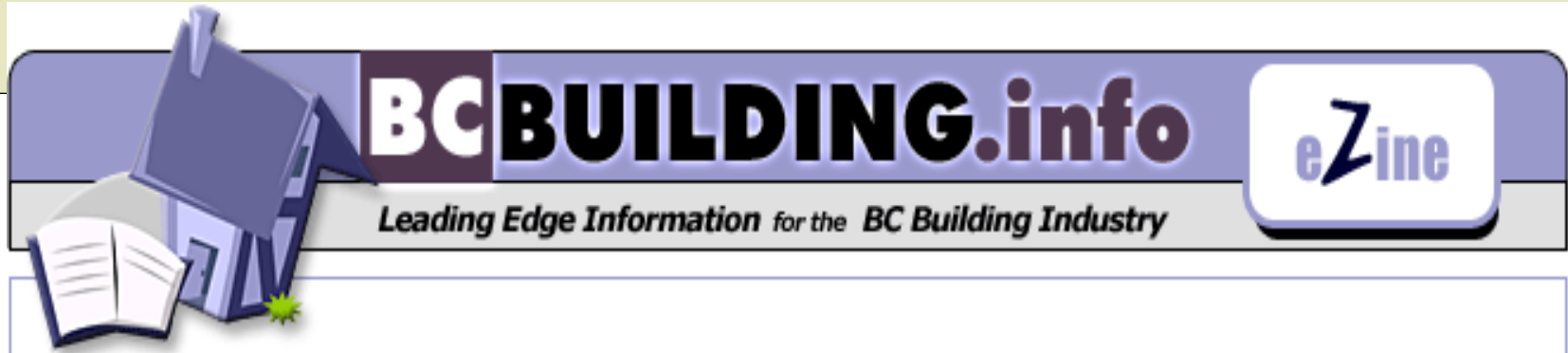
Results of Fungal Mould Resistance Testing MIL-STD 810E Method 508.4		
Sample Description	Grade	Amount of Growth
½ Drywall-White Paint On One Side	1	Trace
½ Moisture Resistance Drywall Sample	3	Moderate
3 ¼ Tongue And Groove Wood Sample	3	Moderate
10" Long Brick	0	None
Concrete Block Unsealed	0	None
Concrete Block with White Sealer Paint	0	None
Concrete Broken and Uneven	0	None
Type II Expanded Polystyrene	0	None

# Other Benefits of Insulated Concrete

- Built-in passive climate control system
- Superior structure
- Heat storage mechanism
- Protection from catastrophic forces

# Reduce Risks & Improve the Bottom Line

- Improve the design process – I.D.P. (LEED)
  - Note: CAC has produced the '**Guide to Sustainable Design With Concrete**' – download from: [www.cement.ca](http://www.cement.ca)
- Specify more appropriate products and systems
- Design for drying and durability (CMHC/IRC)
- Learn from the mistakes of others (litigation is expensive)



Issue # 23: Moisture & Mould  
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7. [Resources – For Buyers, Homeowners, Condominiums](#)

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## Building with Insulating Concrete Forms

*by Donn Thompson  
Program Manager, Residential Technology,  
Portland Cement Association*

*Insulating concrete forms (ICFs) are still new to many homebuilders and contractors. The simple suggestions given here highlight the practical aspects of construction using ICFs.*

Residential contractors are looking for new ways to build. The continued decline in the quality of framing lumber and unpredictable price fluctuations

### ICF Systems

Two characteristics are used to classify the various ICF systems that are

# CONCRETE THINKING

FOR A SUSTAINABLE FUTURE



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**BC Ready-Mixed  
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