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Rousseau, M. Z.

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NRC-IRC Research update

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Rousseau, M.Z.

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NRC-IRC Research Update

by Madeleine Rousseau
NRC-IRC Building Envelope and Structure Program

CHBA TRC meeting Feb. 25 2009
Quebec city



National Research
Council Canada

Conseil national
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Canada



Fire Performance of Houses

➤ **Goal:**

- ❖ Determine the impact on occupant life safety of new residential construction products and systems in single family dwellings

➤ **Phase 1 objective:**

- ❖ Understand factors that affect the ability of occupants of upper storeys to escape in the event of a basement fire and establish sequence of events

➤ **Scope:**

- ❖ Full-scale fire experiments simulating a severe fast growing fire originating in a basement
- ❖ Range of unprotected engineered floor systems (wood I-joist, steel C joist metal plate and metal web wood truss and solid wood joist assemblies)

➤ **Status:** completed in Dec 2008. Summary report posted on NRC website. Follow up study initiated.

➤ **Next Step:** 2008-2010: investigate effect of fire protection measures on the wood flooring systems investigated in first study.



Building Science Insight Seminar Series

➤ BSI 2008-09 :

- **Topic:** Single and multi-family houses: improving performance through a systems approach
- **Content:**
 - Ventilation and heating systems
 - High-performance windows
 - Fire resistant & acoustic separations
 - Liveable basements
- **Status:** Completed. Presented in 15 locations across Canada. Direct outreach to nearly 700 participants.
- **Next Step:** Prepare webcast of talks for sale in summer 2009

➤ BSI 09-10 :

- **Topic:** Energy efficiency in large buildings
- **Preliminary content:** energy code, effect of lighting and HVAC equipment, building envelope



Window Installation and Water Management

- **Goal:**
 - Better understand factors for effective water management performance of several wall/window interface details for wood-frame and commercial applications
- **Consortium:** CMHC, DuPont, BDTI and PWGSC
- **Scope:**
 - ❖ Side-by-side testing of wall/window interfaces exposed to a range of wind-driven water loads. Detection and quantification of water accumulation in critical locations of the assemblies
- **Status:** Testing completed. Report writing stage. NRC and CMHC gave several talks on project outcomes.
- **Next Step:** 2008-09: Follow up experimental study to investigate condensation potential on window frame with different wall/window interface detailing.



High Performance Building Envelopes

- **Walls:** Project on durability and moisture performance of highly insulated exterior walls (2)
- **Walls:** Project on energy efficiency of next generation of building envelope systems
- **Walls:** Project on Wall Energy Rating of spray polyurethane foam insulated wall assemblies
- **Insulation materials:** Development and testing of Vacuum Insulated panels (VIP) with R36 per in.



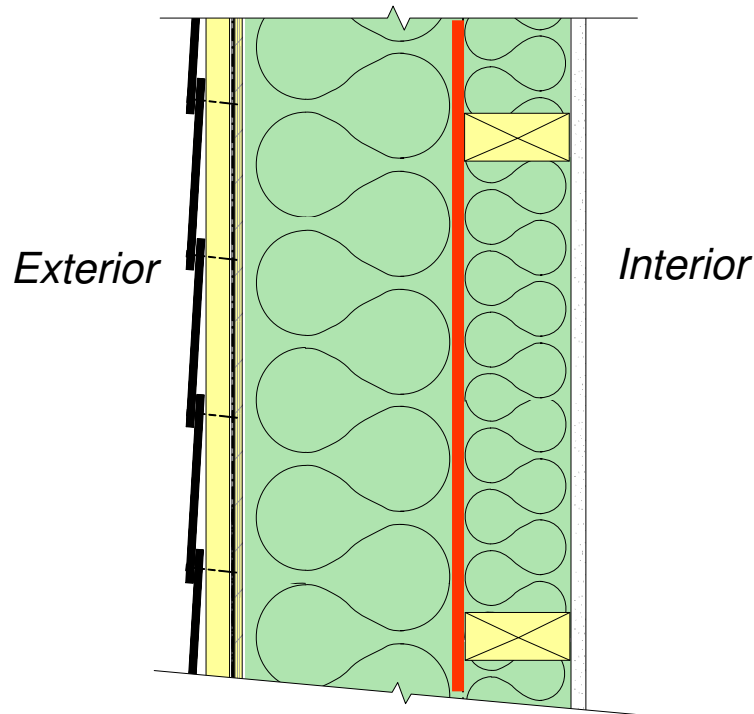
Building Envelopes for Canada's Arctic Regions

- **Objective :** Develop and evaluate energy efficient and durable wall assemblies for extreme *outdoor* and *indoor* climates
- **Partners:** CMHC, NRCCan, PERD
- **Scope**
 - Assess heat and moisture performance of wall assemblies in extreme climates
 - Focus on northern and northern-coastal regions
 - Consider minimum energy and environmental impact of the wall assemblies

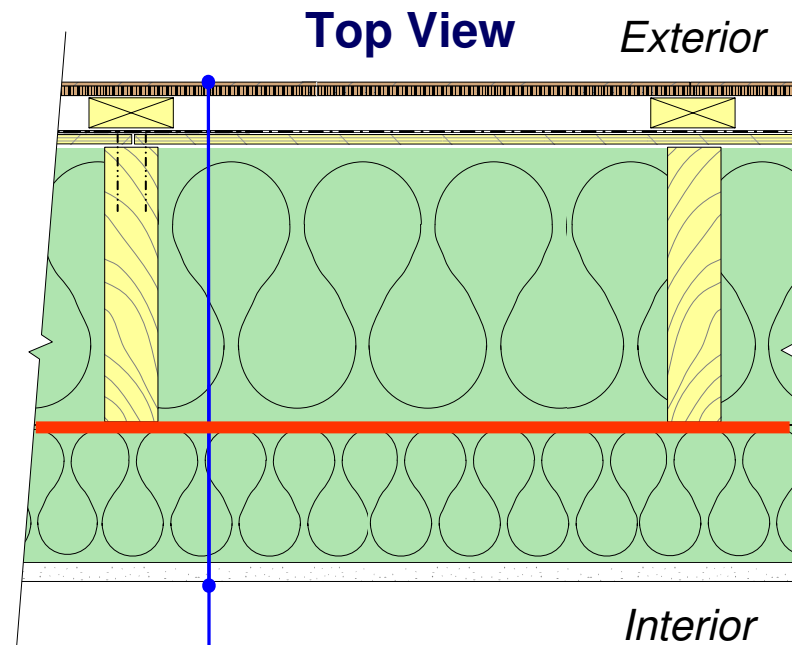


Arviat Nunavut 2007

W3 Specimen – Wrap and Strap Wall CMHC E2 Project in Dawson YT

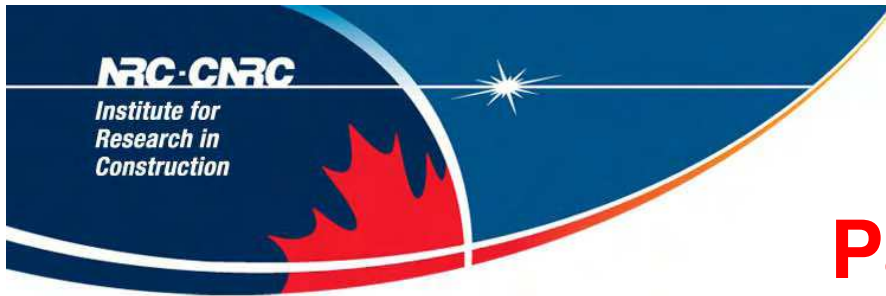


Side View

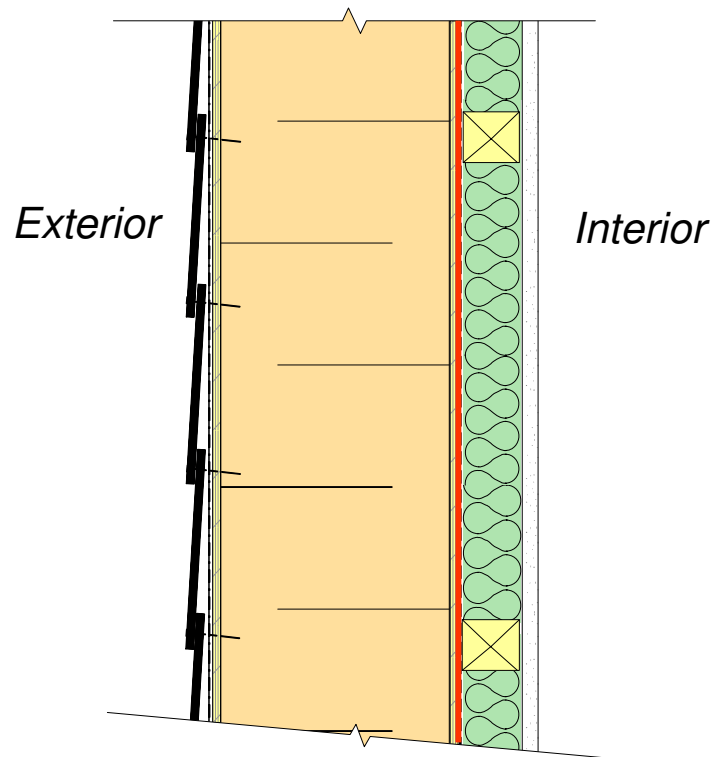


- Hardboard lap siding (1 x 6 boards)
- 1 x 3 vertical strapping
- Sheathing membrane
- OSB (7/16 in.)
- 2 x 8 framing @ 600 mm (24 in.) o.c. /
 - 7.5 in. mineral fibre insulation
- Polyethylene air and vapour barrier
- 2 x 4 horizontal strapping / 3.5 in. mineral fibre
- Gypsum board (½ in.)

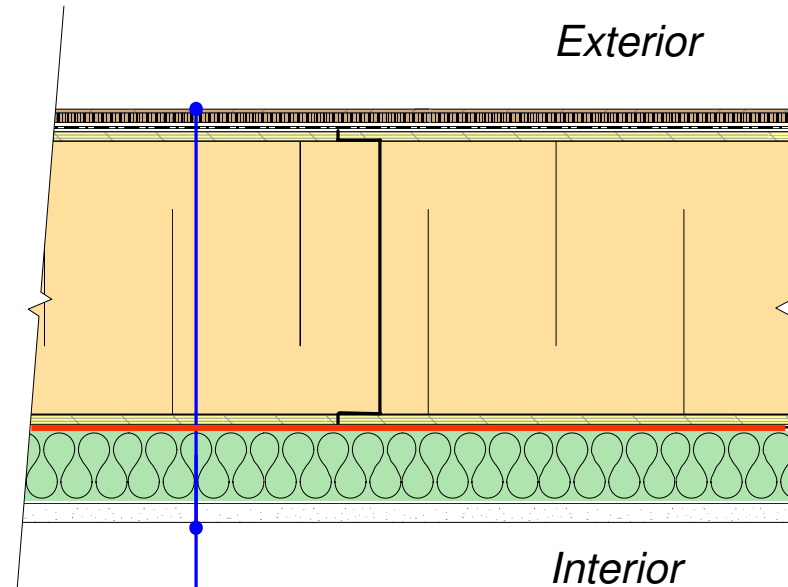
$$R_{eff} = 33$$



W4 Specimen – Structural Insulated Panel and Interior Insulation



Side View

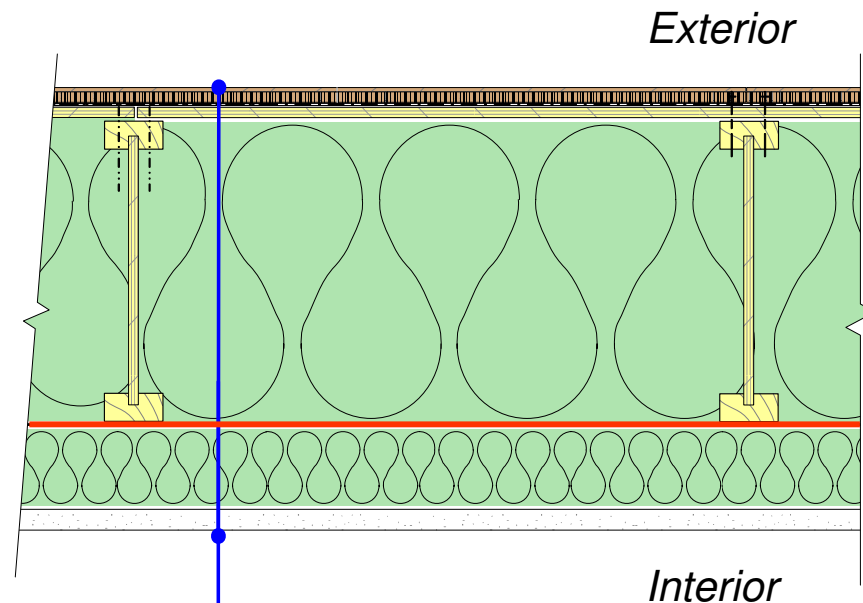
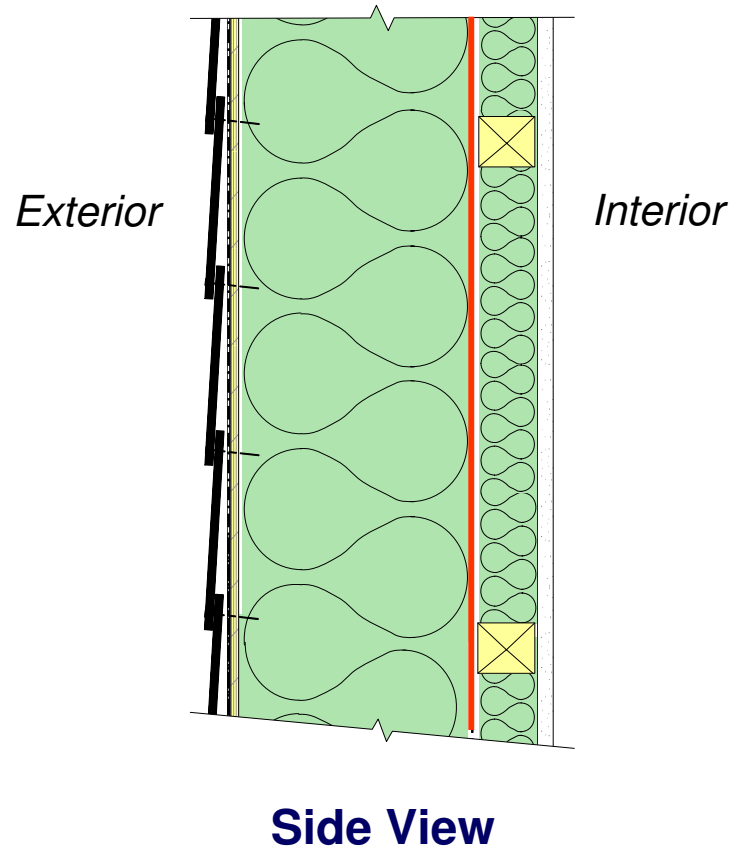


- Wood siding
- Sheathing membrane
- Load-bearing SIP (6.5 in. EPS)
- Polyethylene air and vapour barrier
- 2 x 2 horizontal strapping @ 24 in. /
- 1.5 in. mineral fibre semi-rigid insulation
- Gypsum board

$$R_{eff} = 31$$

Top View

W5 Specimen – I-Joist and Interior Insulation

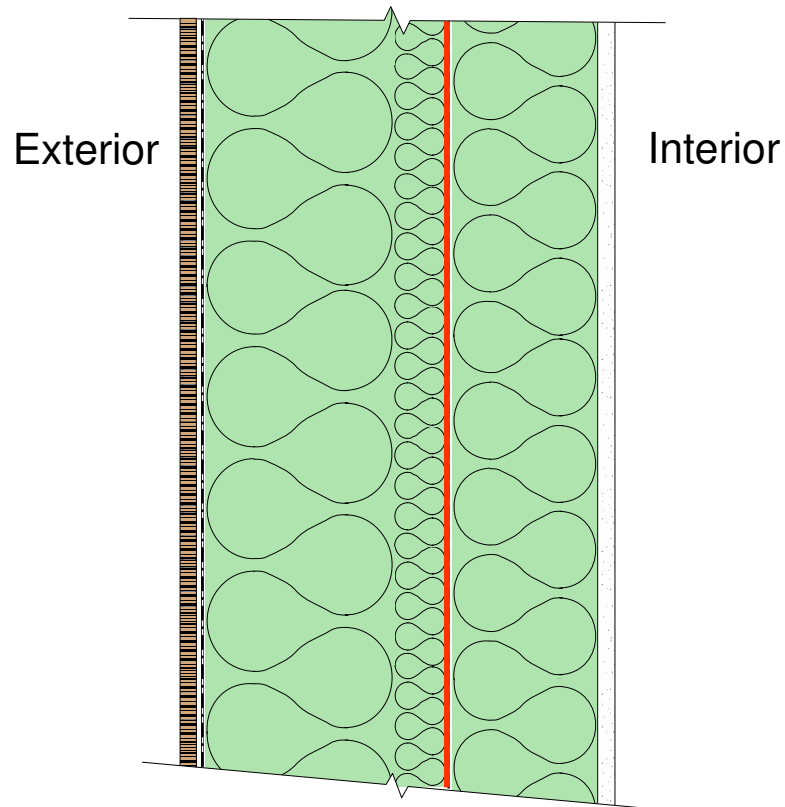


- Wood siding
- Sheathing membrane
- OSB (7/16 in.)
- 7.5 in. I-Joist / mineral fibre
- Polyethylene air and vapour barrier
- 2 x 2 horizontal strapping @ 24 in. /
 - 1.5 in. semi-rigid mineral fibre
- Gypsum board (1/2 in.)

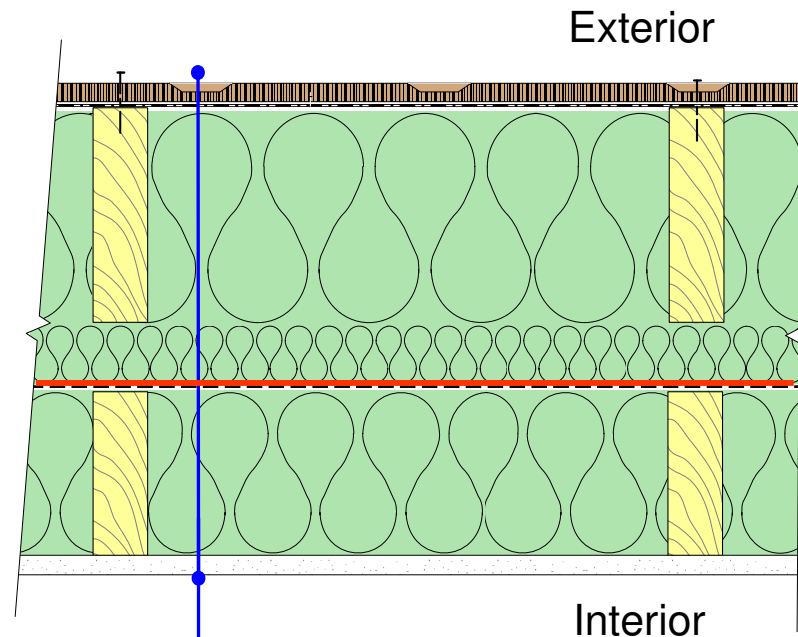
$R_{eff} = 26$

Top View

W6 Specimen – Double Wall Construction CMHC E2 proposal in NU



Side View



- SmartPanel Siding
- Sheathing membrane
- 2 x 6 mineral fibre R-22 / framing 24 in. o.c.
- 2 in. gap with mineral fibre batts R-10
- Polyethylene air and vapour barrier
- Framing 24 in. o.c. 2 x 4
 - semi rigid insulation R-13
- Gypsum board (1/2 in.)

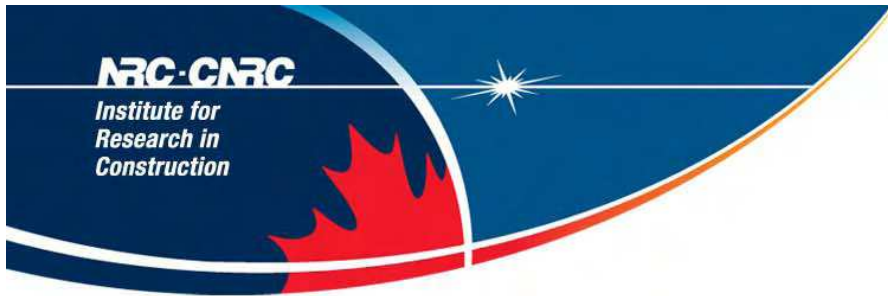
$$R_{eff} = 33$$

Top View



Wall Energy Rating of SPF Walls

- **Goal:** Determine WER (including air leakage and thermal conductance) of SPF wall assemblies and to develop calculation model to predict WER without testing
- **Scope:**
 - Develop laboratory test method
 - Conduct testing on wall samples
 - Develop calculation procedure and correlate testing results to calculation procedure
- **Partners:** CUFCA, BASF Canada, Demilec, Honeywell int'l USA
- **Status:** near completion (Dec. 2009)



Vacuum Insulated panels (VIPs)

- **Goal:** advance the development of high performance insulation materials
- **Scope:**
 - ❖ Identify nano-porous materials for core material
 - ❖ Assemble new apparatus to test vacuum insulation
 - ❖ Assess performance of these VIP
- **Partners:** NRCCan, CMHC and Kingspan Insulation
- **Complementary new (2008-2012) project:** to assess energy efficiency of VIP into wall assemblies



HAM response of retrofitted walls



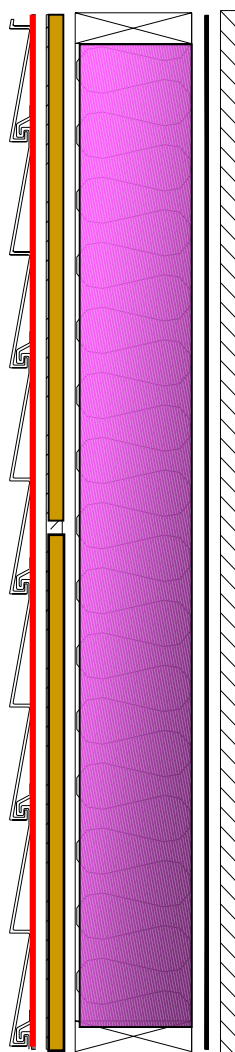


Conditioning Chamber on the Room Side

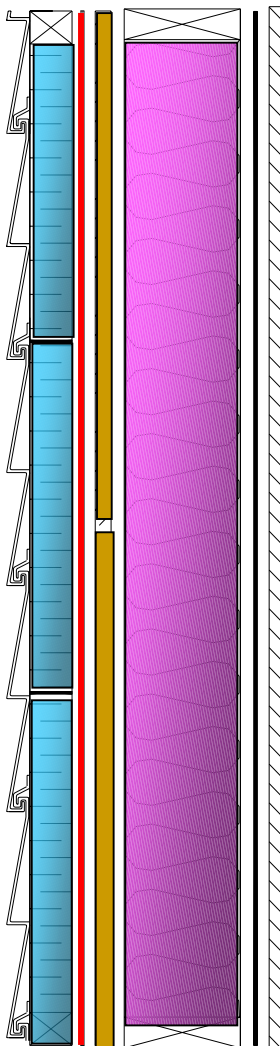


The 3 Test Specimens

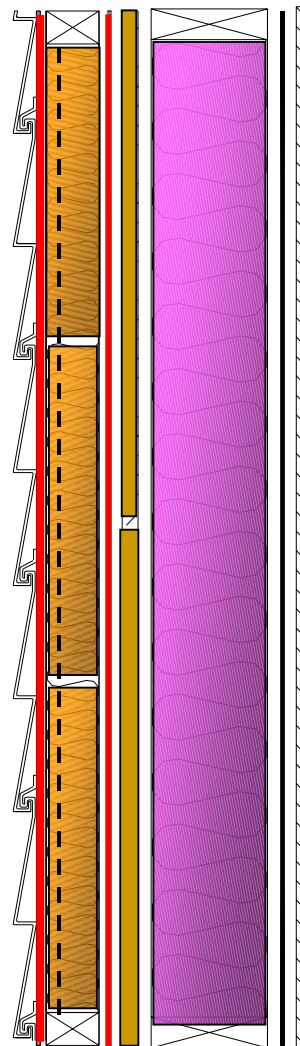
Exterior



**R20 2X6
typical
construction**



**Addition of a Low Air
and Vapour Permeance
Insulation**

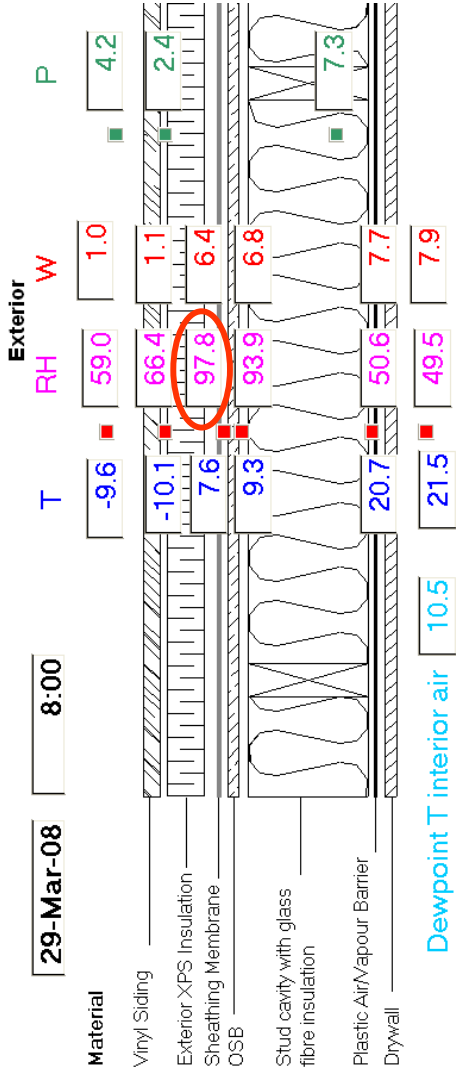


**Addition of a High Air and
Vapour Permeance Insulation
& sheathing membrane**

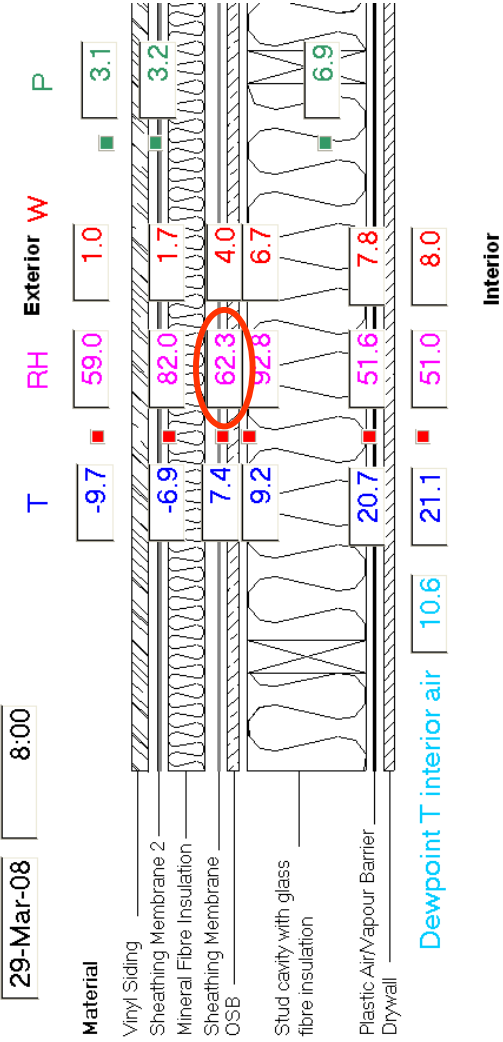
Interior

Moisture Effects

Wall 2 - XPS



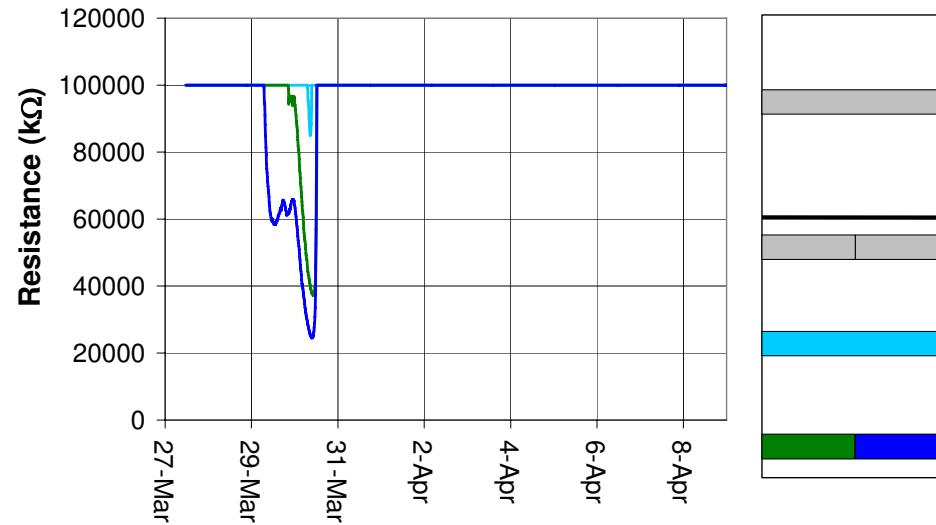
Wall 3 - Mineral Fibre



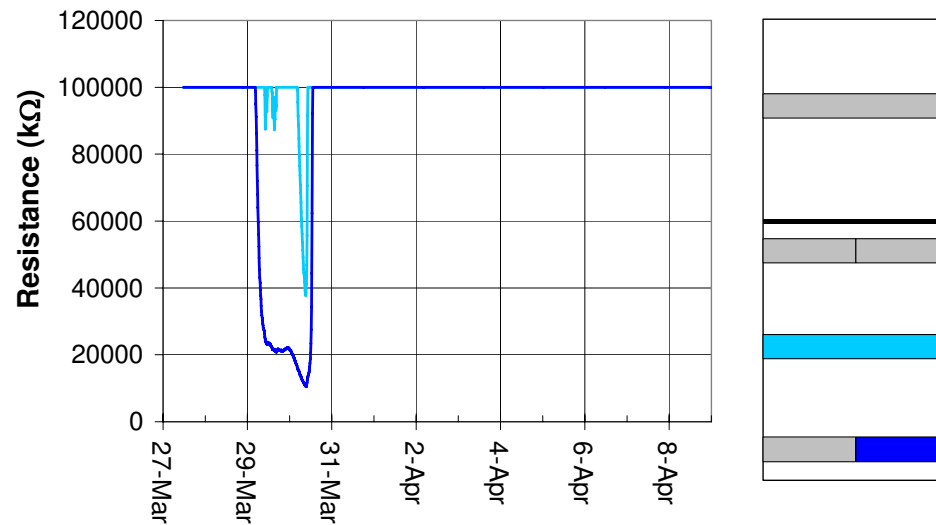
Liquid detected during Condition E2



Wall 2 (XPS) - Interior of OSB Liquid Detection Tape

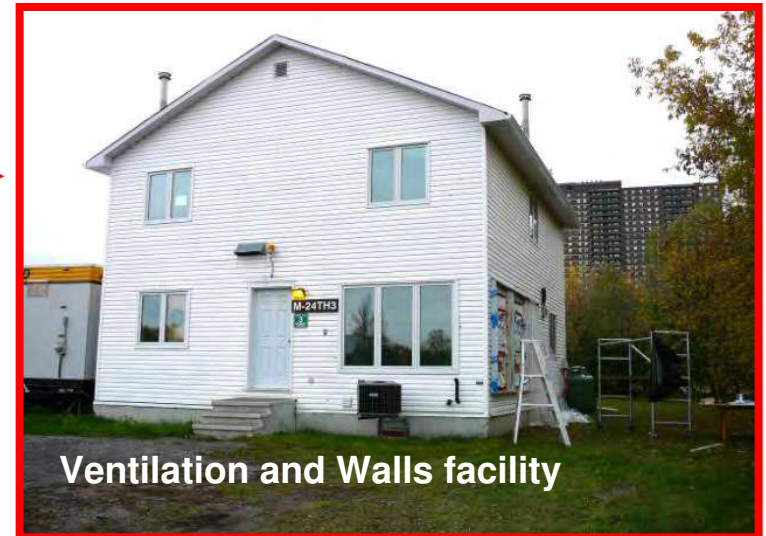


Wall 3 (Mineral Fibre) - Interior of OSB Liquid Detection Tape



HVAC Systems

- Hybrid ventilation systems
- Hybrid heating systems
- Desiccant-based evaporative cooling



Ventilation and Walls facility

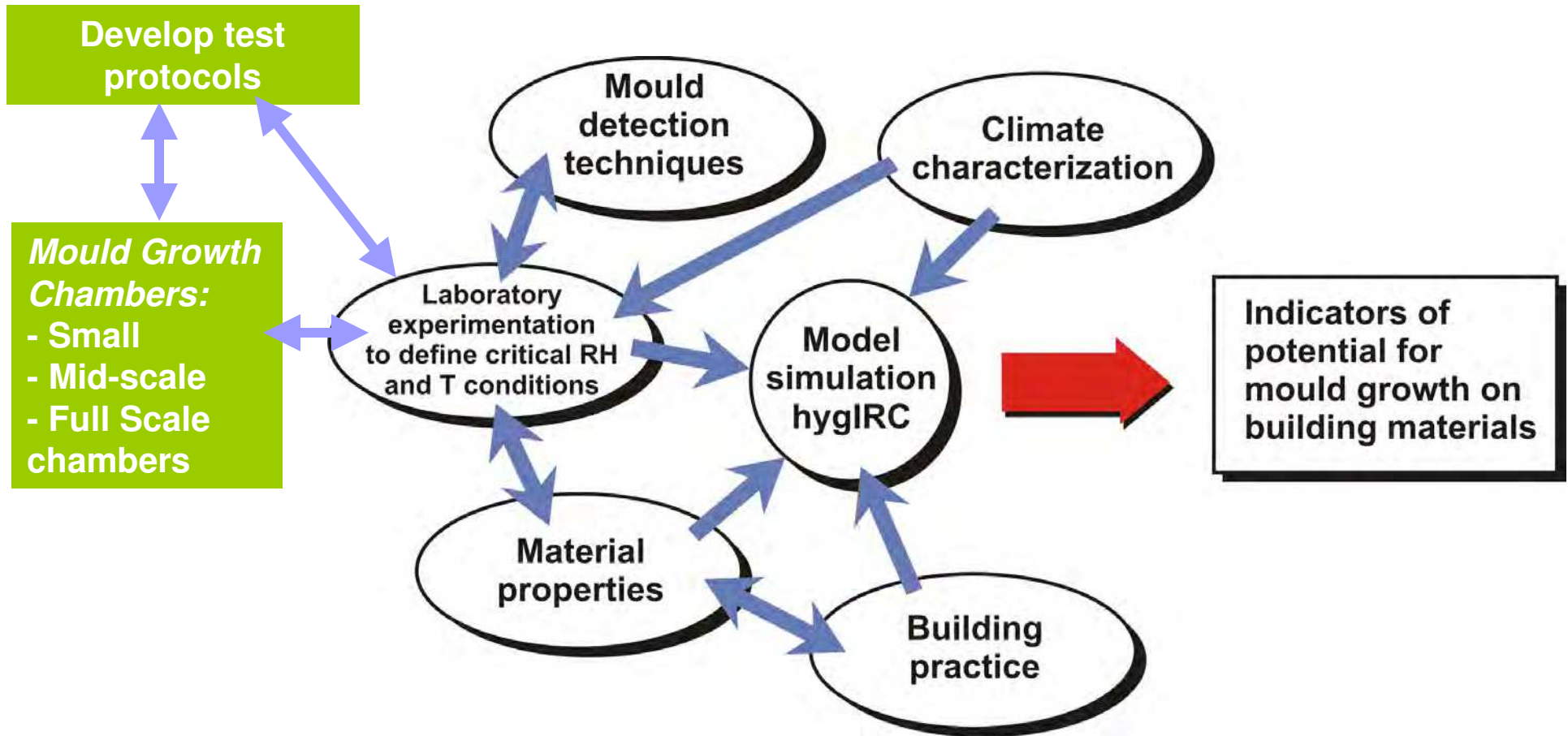


Canadian Centre for
Housing technologies

Experiment
conducted last
summer; Not
very hot and
humid though.
Report writing
stage;

Experiments are
running this
winter. Reports
expected in
Summer.

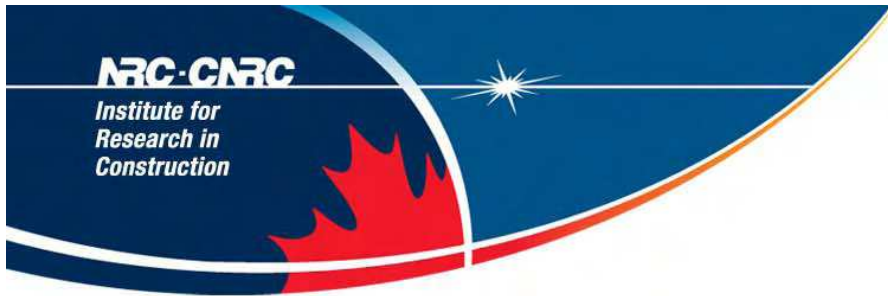
Mould Growth in Buildings A Multi-disciplinary Approach





Mould Research

- Commissioning of new lab facilities almost done
- Hiring and training of new researchers under way
- Getting ready to conduct first set of experiments
- Sampling mould spores in 100 homes in Quebec city-
Study on health and impact of indoor environment



Indoor Air Initiative

- **Goal:** contribute to better occupant health through improved air quality in buildings
- **Scope:**
 - ❖ Study the correlation between ventilation, air quality and health (Field study in 100 homes)
 - ❖ Develop methods to assess technologies meant to improve air quality
 - ❖ Provide a national forum for decision-makers
- **Partners:** Quebec National Public Health Institute, Health Canada and others



Indoor Air Facility

- **Research focus:**
Measure impact of strategies, testing of technologies meant to improve air quality
- **Flexibility in design:**
Can replicate different types of housing, flexibility in wall design & air leakage

