Masonry Ventilation & Best Practices - BCIT Test Hut Results

BCBEC AGM
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Masonry Contractors
Masonry Suppliers

Bill McEwen
JP LeBerg

Designer Assistance:

- Seminars
- Office Present.
- Tech. Manual / Website
- Enquiries
- Codes & Stds.
- **Research**

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Presentation Outline

- Review Masonry Rainscreen
  - Rainscreen Cavity System
  - Materials
  - Details
- BCIT Test Hut:
  Cavity Ventilation Program
  - Wall Configurations
  - Instrumentation & Data
  - Results: 2008; 2009
- Conclusions

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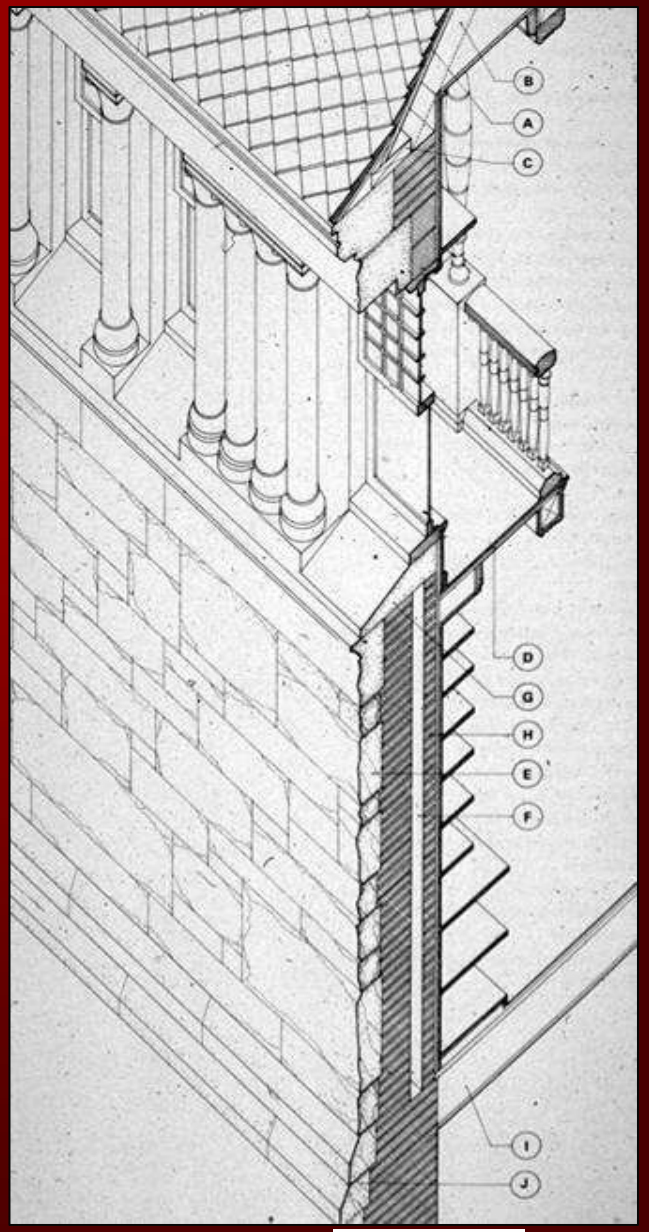
Masonry Cavity Walls

- Palladio (1570):

  "*It is very commendable in great fabricks, to make some cavities in the thickness of the wall from the foundation to the roof, because they give vent to the winds and vapours, and cause them to do less damage to the building.*"



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New Concept ??

Brick on Wood Frame - Vancouver circa 1930

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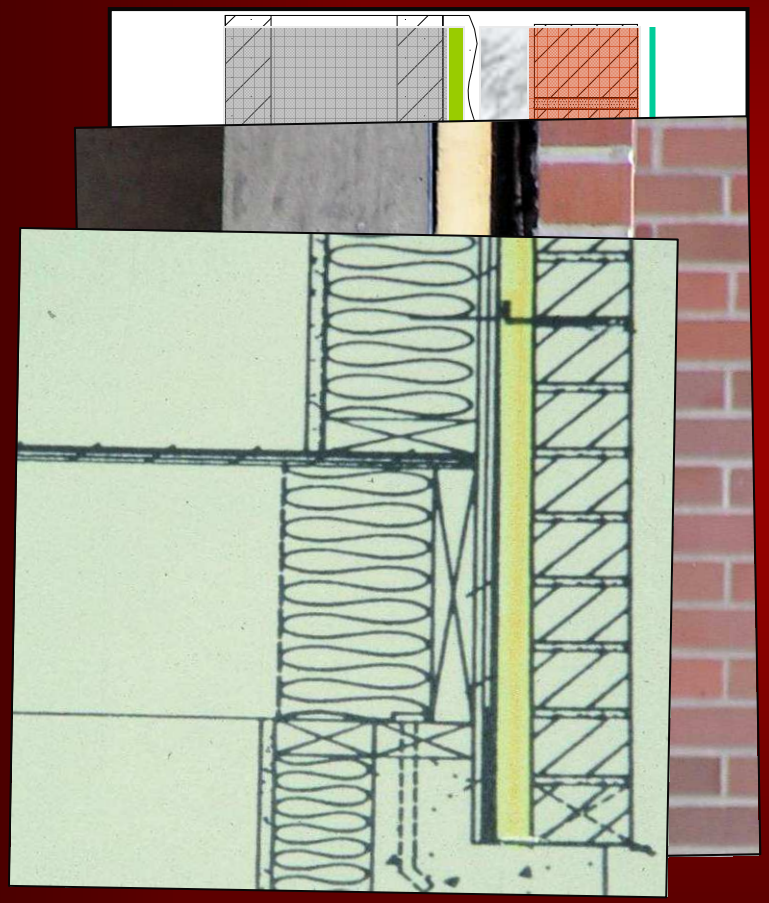
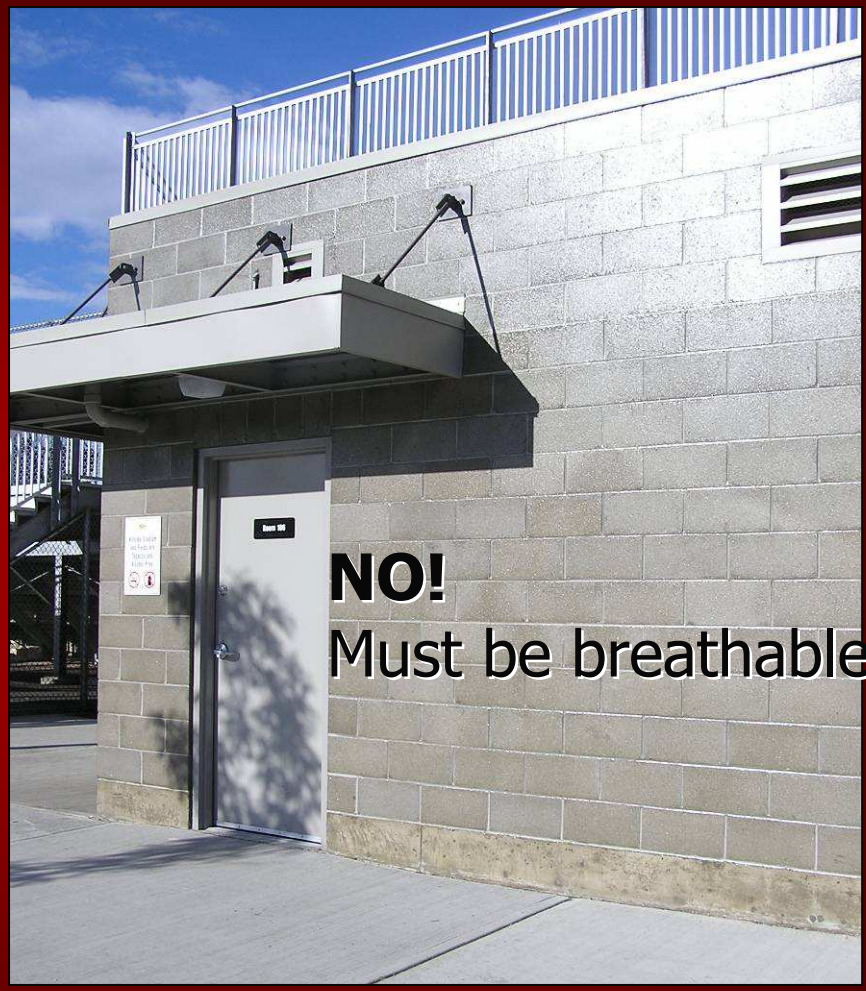
Masonry Veneer Rainscreen





No Repellant in BCIT Tests

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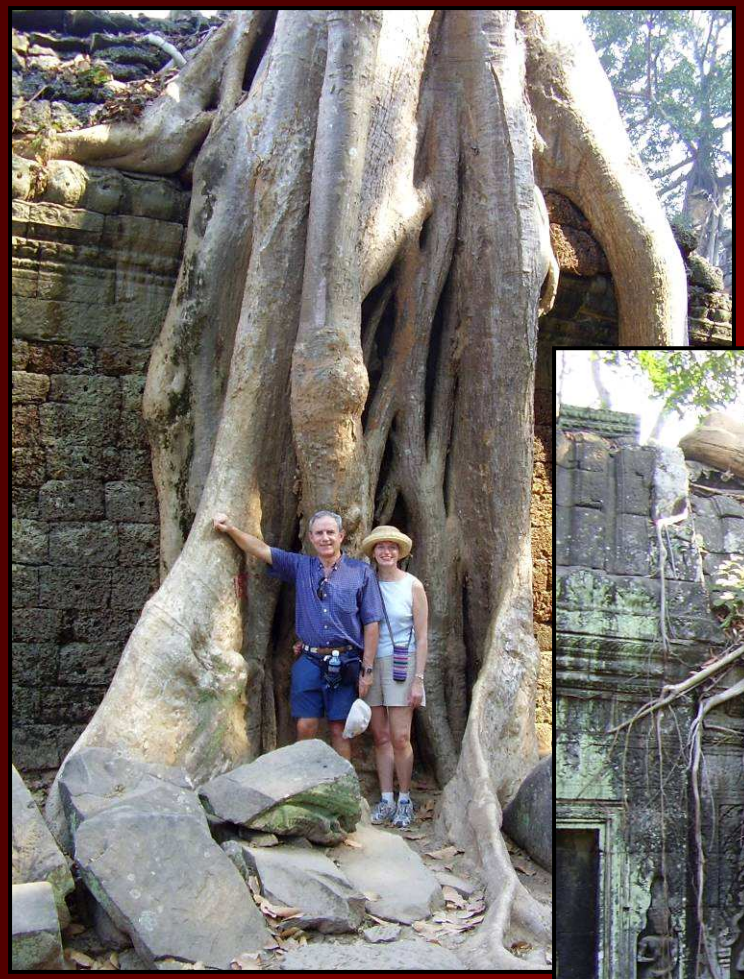

Goal to Avoid Organic Attack!
- rot, mould, mildew

Ta Prohm Temple
Ankor Wat, Cambodia (1200 AD)

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Veneer Materials

Clay Brick (Test Hut)

Concrete Block
- Groundface Units

Stone

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The Role of Mortar

- Structural
- Water Penetration Resistance

- Workability ➡ Bond
- Full joints
- Tooling - Concave

Used at Test Hut

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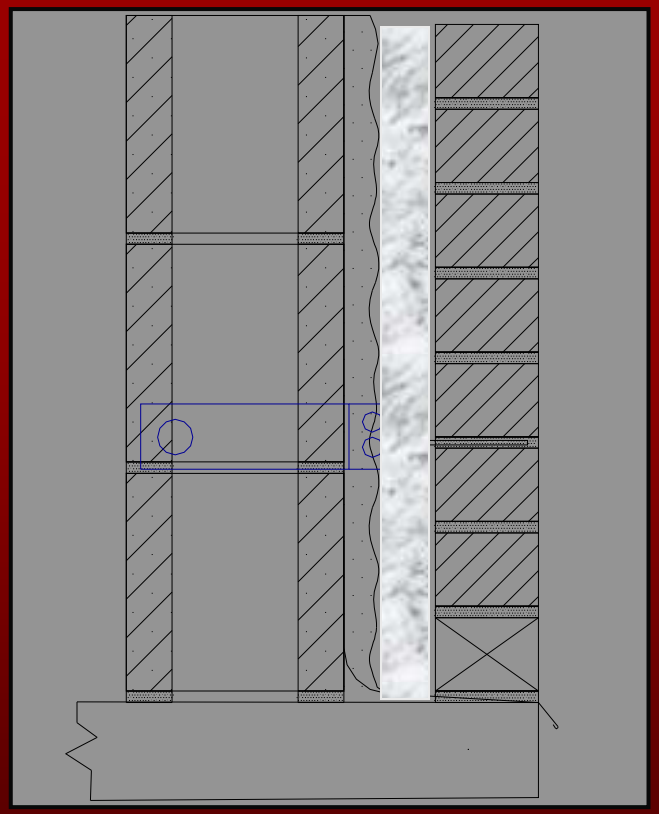
Masonry Veneer Rainscreen



Airspace Cavity:

- Capillary Break between Cladding & Back-up
- Drainage
- **Ventilation Drying**
- Accommodates Tolerances
- Insulation Location

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Cavity Width

- 25 mm Minimum
  (versus 10 mm ??)

Used at Test Hut

40-50 mm Accommodates Tolerances in Backup

Future Research?

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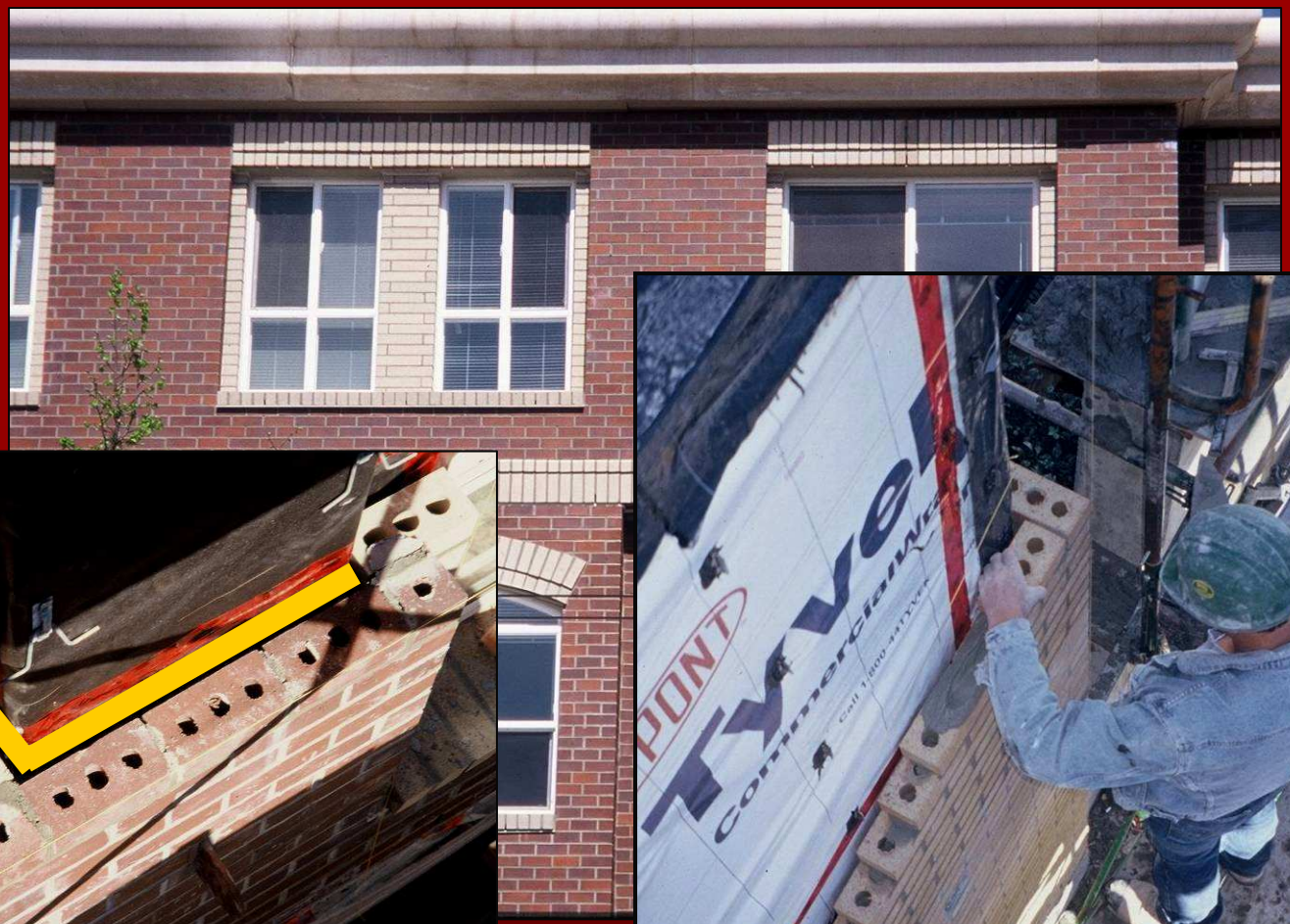

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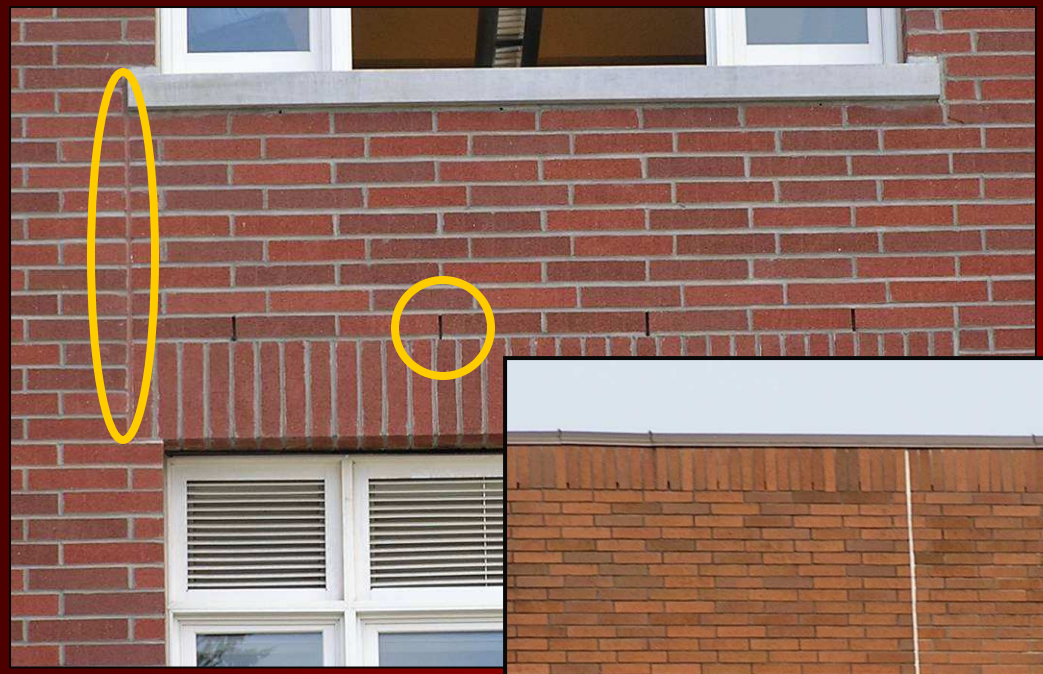
Weepholes & Vents



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Weepholes / Vents

Top vent

Screen device

Empty head

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Test Hut Program Questions:

- Would cavity ventilation be beneficial in BC's coastal climate – particularly for absorptive cladding such as brick veneer?

- Would the introduction of top vents lead to higher moisture contents due to rain penetration?

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November, 2007

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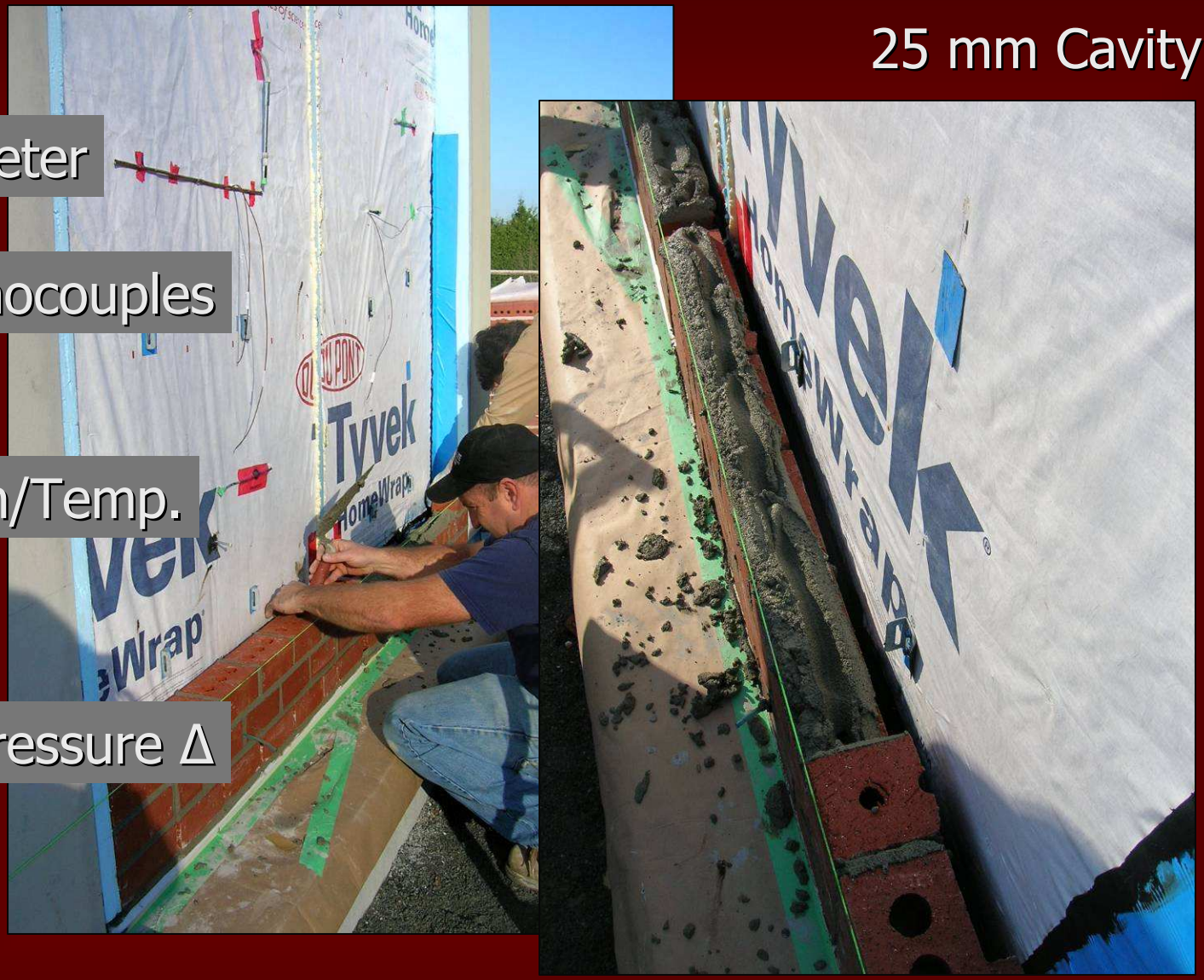
25 mm Cavity

Anemometer

Thermocouples

Rh/Temp.

Pressure Δ



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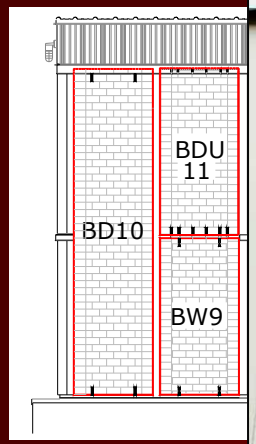
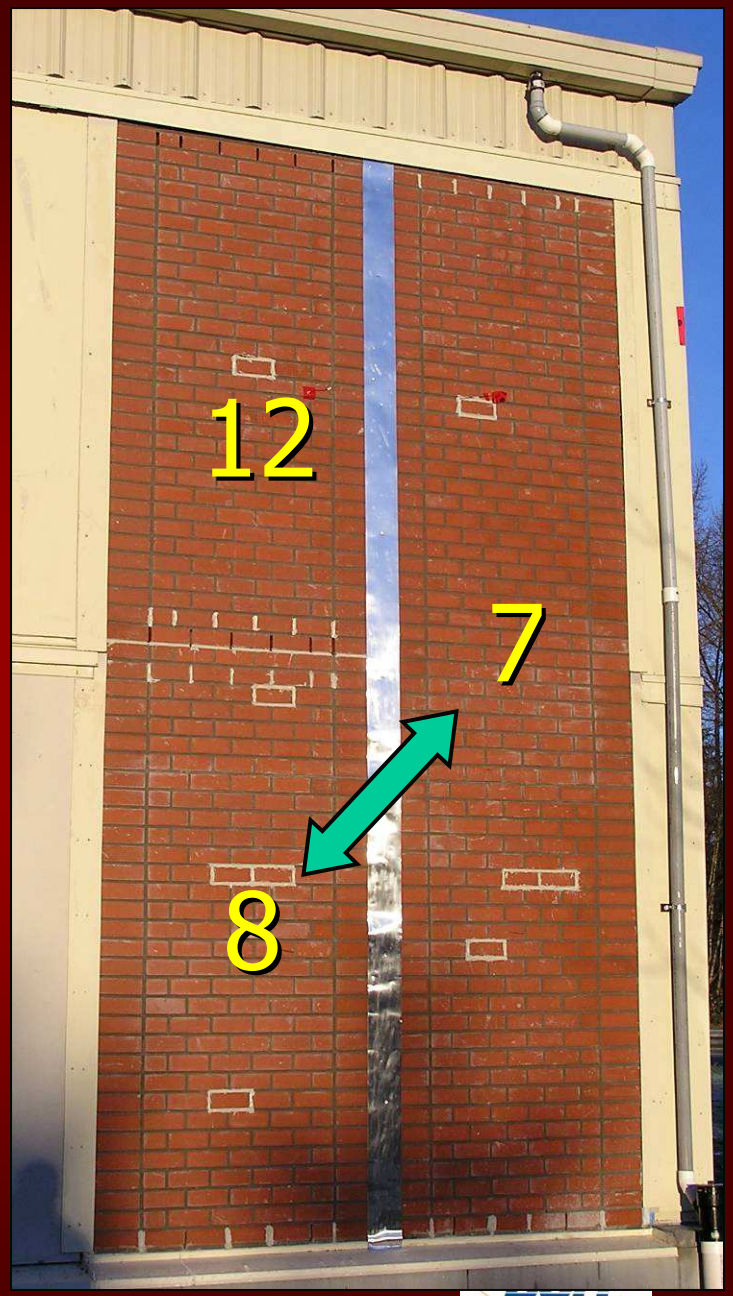


All Open
(some protection)

Pre-wetted sheathing in 2008



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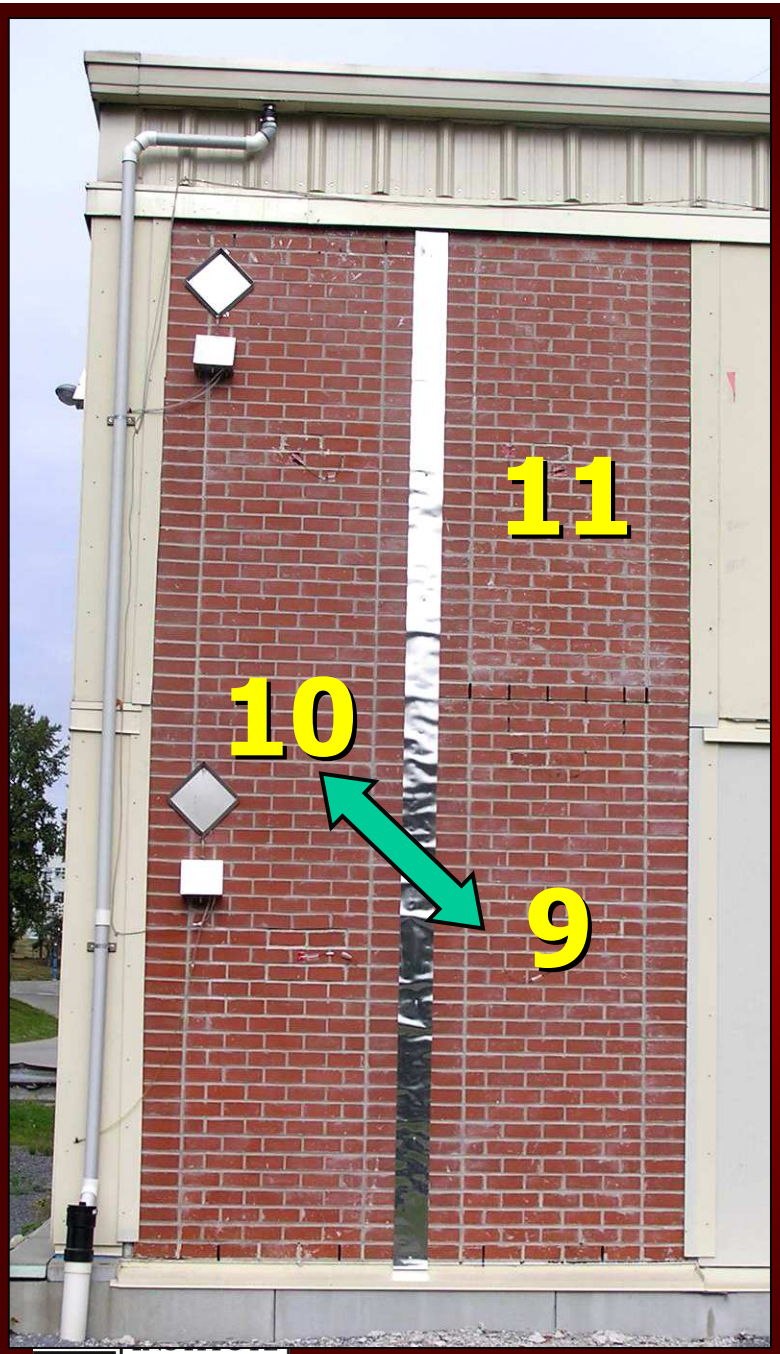

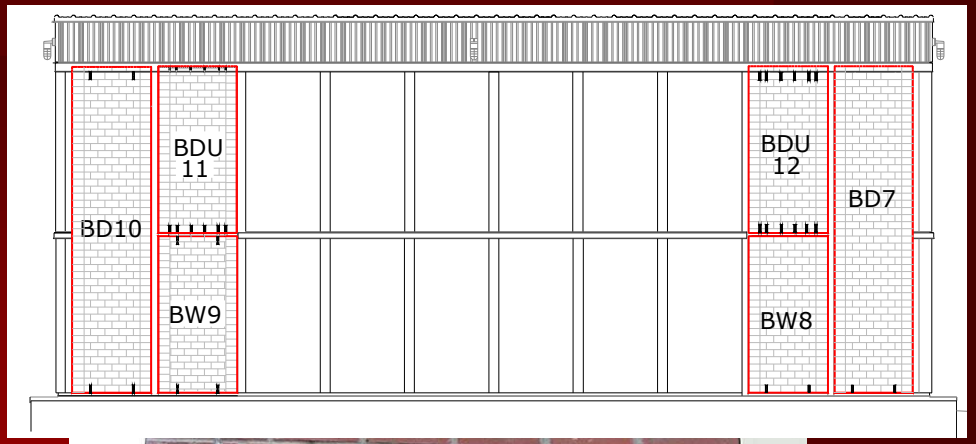

Pre-wetted sheathing in 2008

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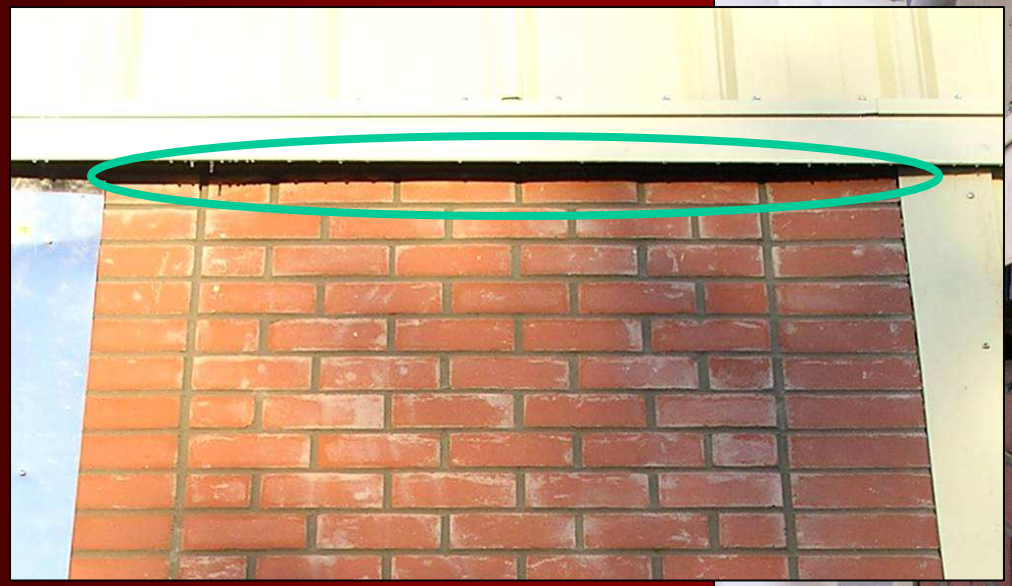
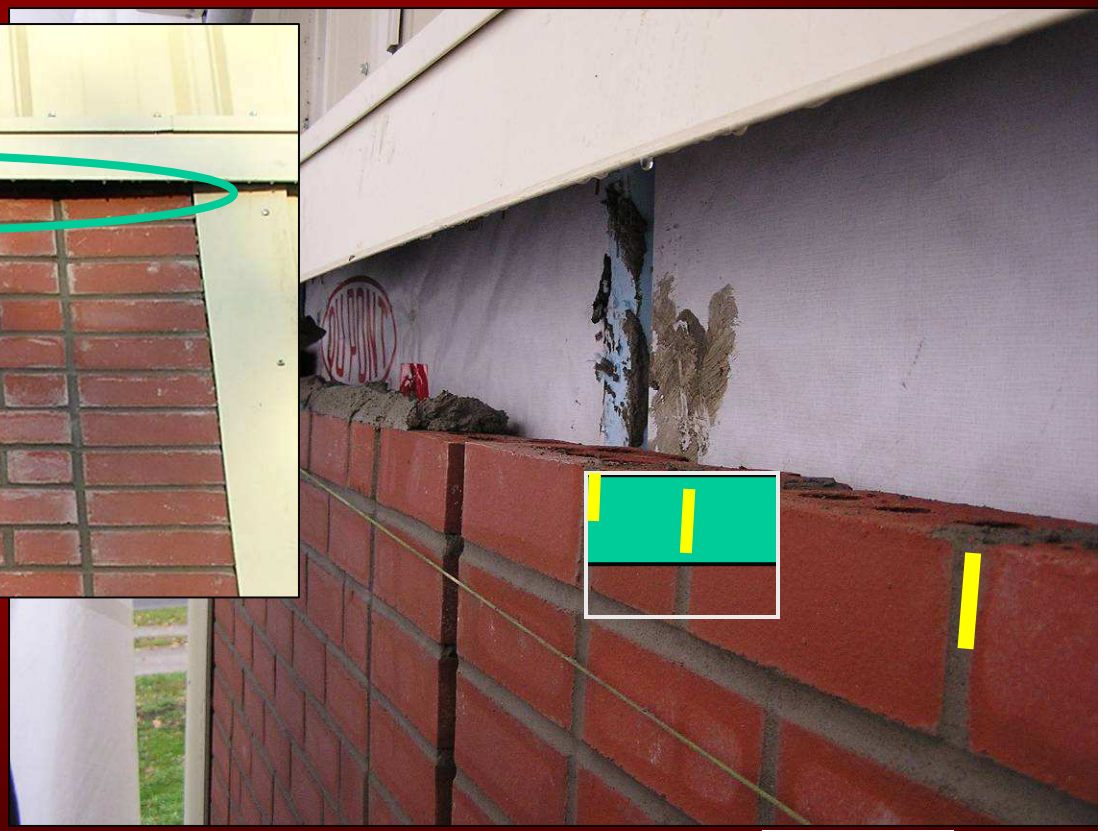
Wall 11 Top vents:
- no mortar in top half of all head joints under cap flashing





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Objectives

- More information about the test set-up and results, can be found in papers presented at:

  12th CCBST and 4th IBPC

- Qualitatively estimate the influence of vent openings and cavity heights on ventilation rates by measuring cavity air speed.

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Field Experimental Set-up

Measurements included

Temperature

RH

Wind speed

Wind direction

Global solar radiation

Horizontal rainfall

Wind-driven rain

Building envelope test facility (BETF) and its roof weather station

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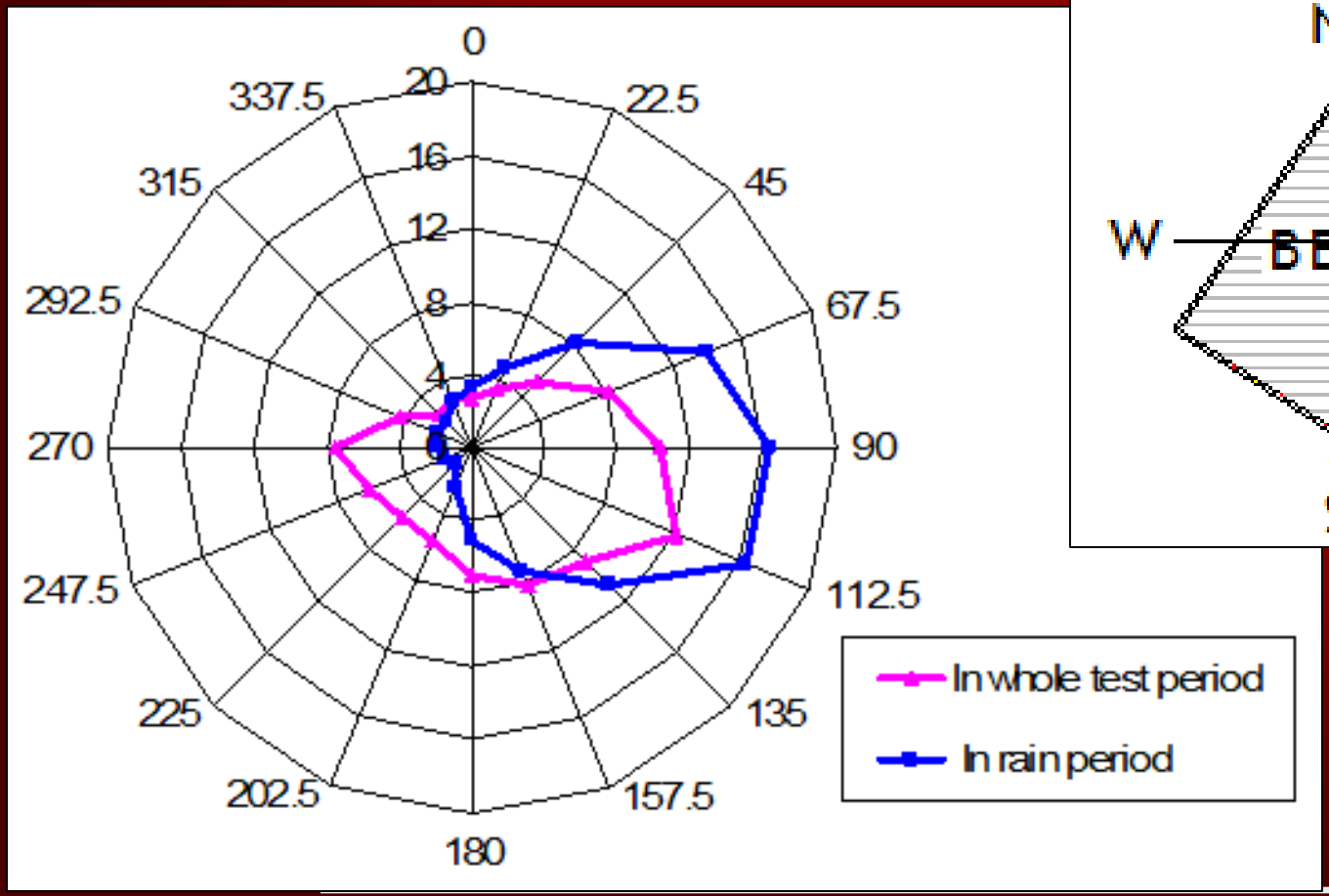
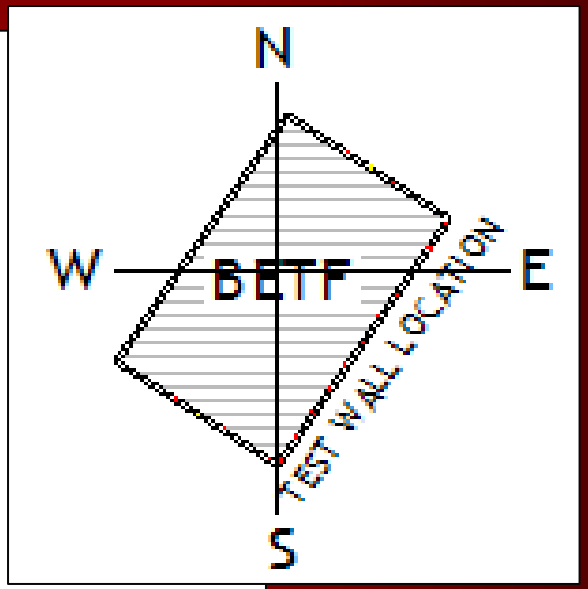
Field Experimental Set-up

Prevailing wind direction

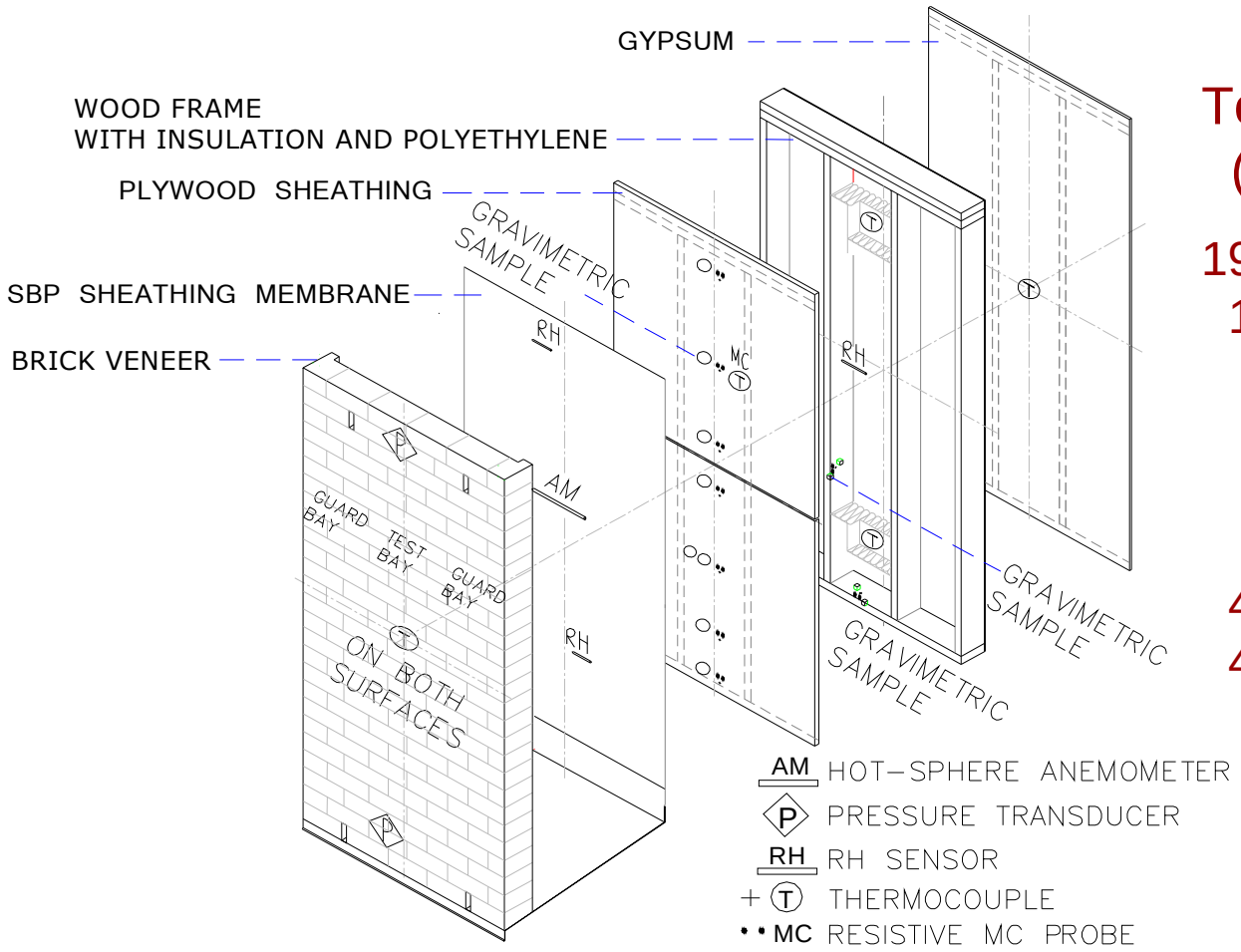


Building envelope test facility orientation



Field Experiment Set-up

Instrumentation



Total Instruments:
(6 panels)

195 - thermocouples
13 - RH-T sensors
4 - hot sphere anemometer
4 - pressure transducers
45 - pairs of MC pins
48 - gravimetric in plywood, studs and bottom plates

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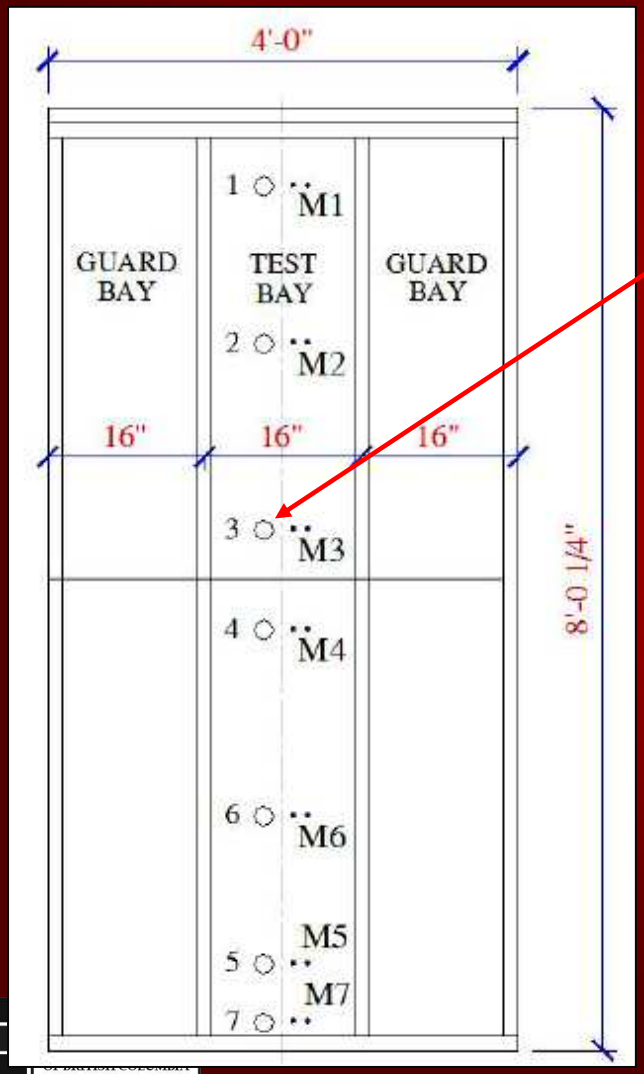
Field Experiment Set-up

Sheathing Moisture Instrumentation

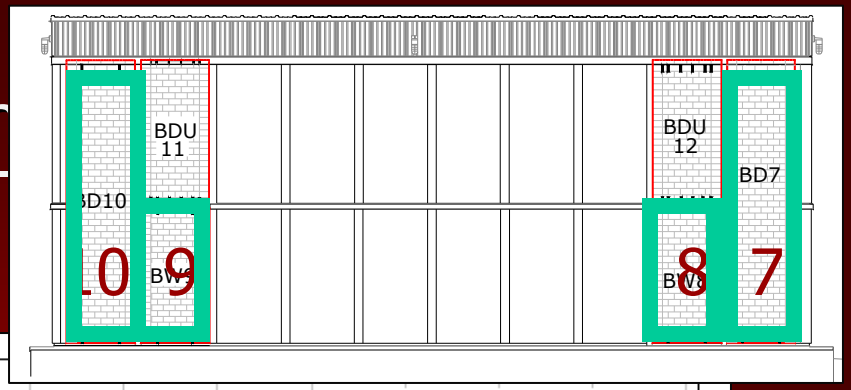


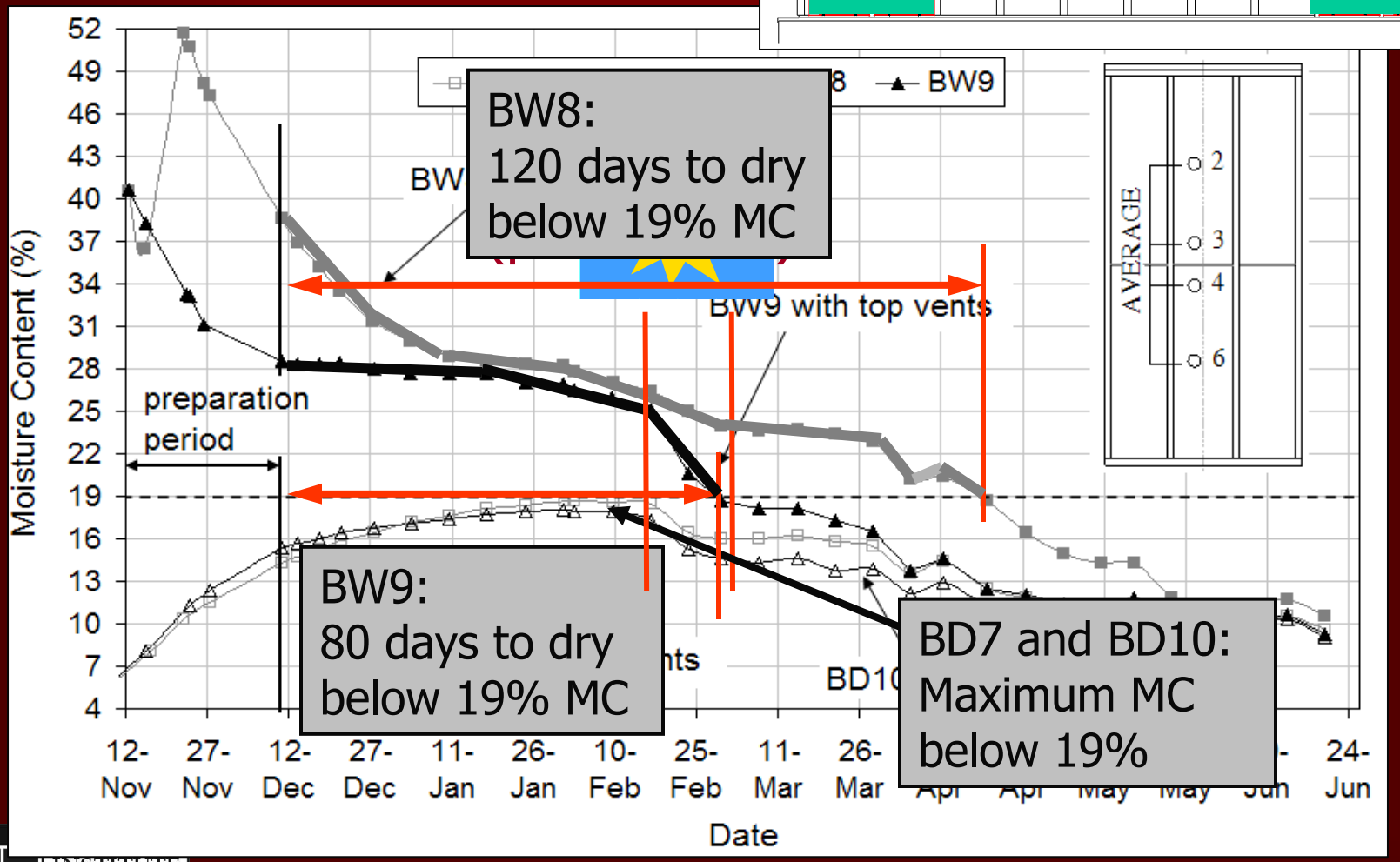
Gravimetric sample
(2” diameter disks in plywood)

Results and Discussion

Moisture conter

Gravimetric MC measurement in plywood in winter and spring of 2008





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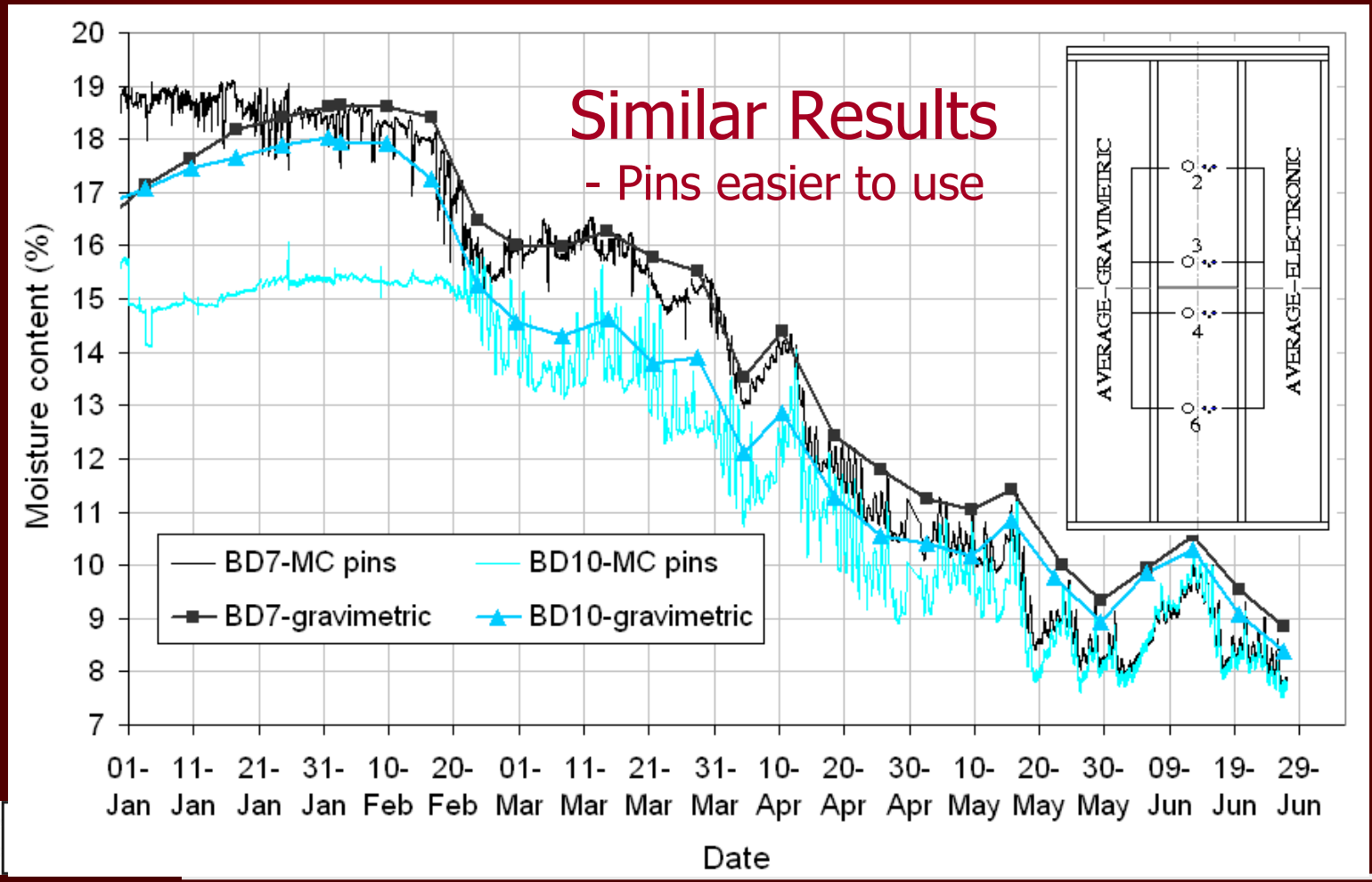
Moisture content measurements

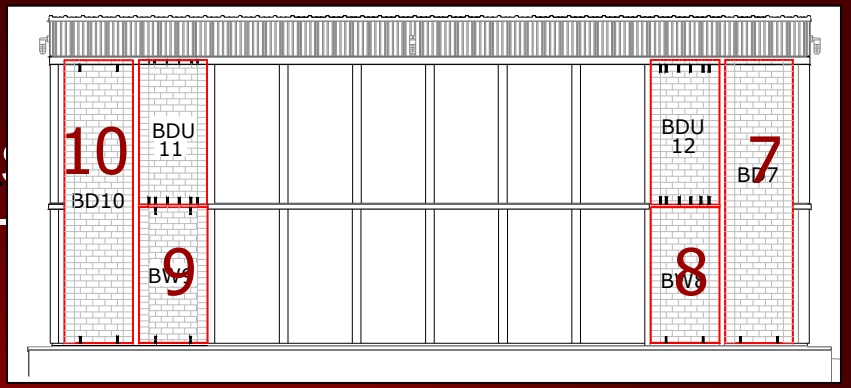
Average MC of gravimetric versus pin measurements

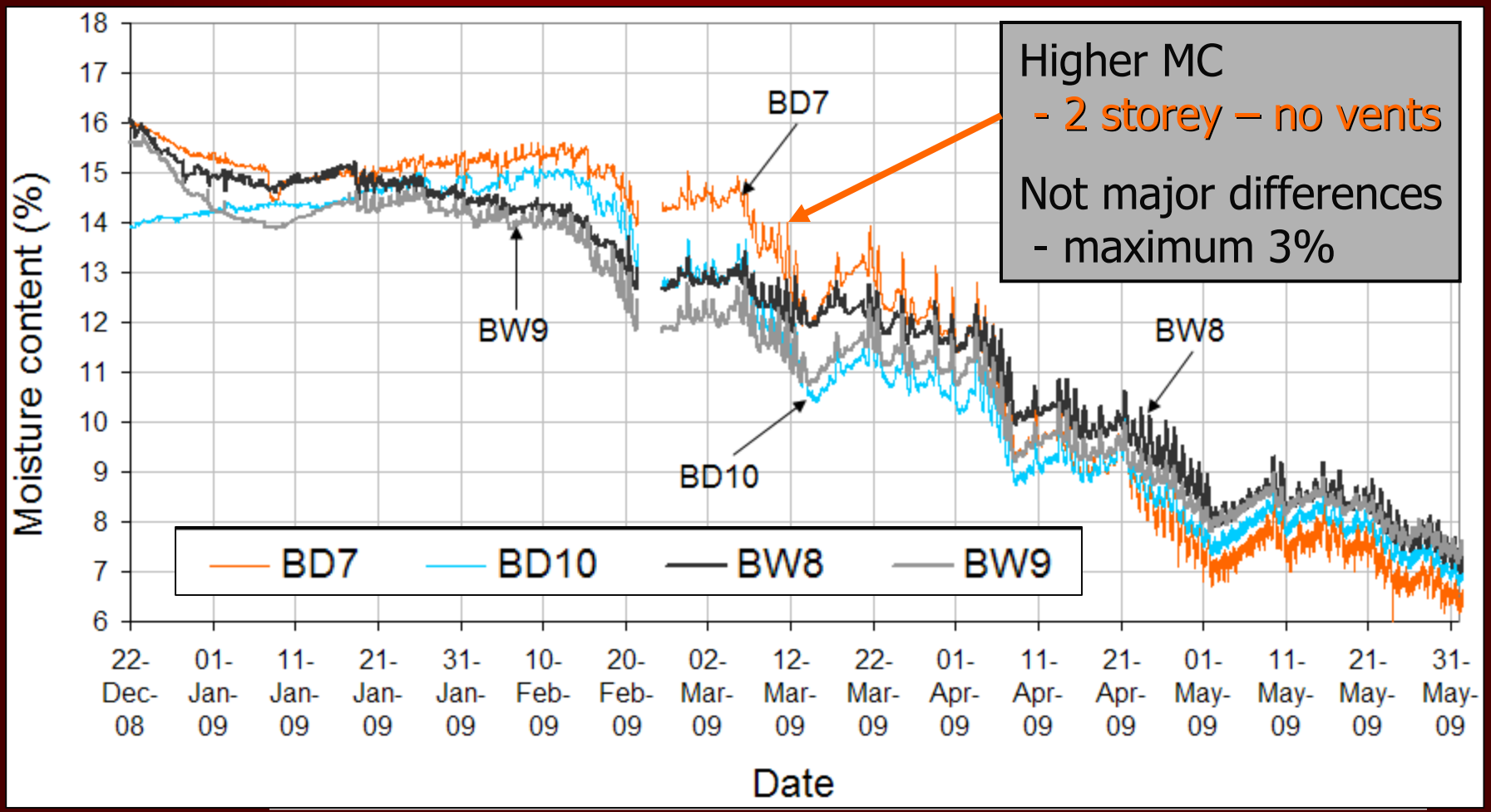


Results and Discussion

Moisture content meas

Comparison: - vent configurations
- cavity heights

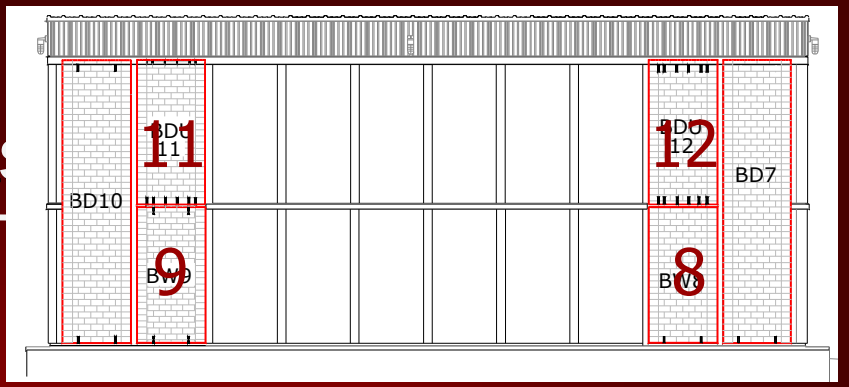


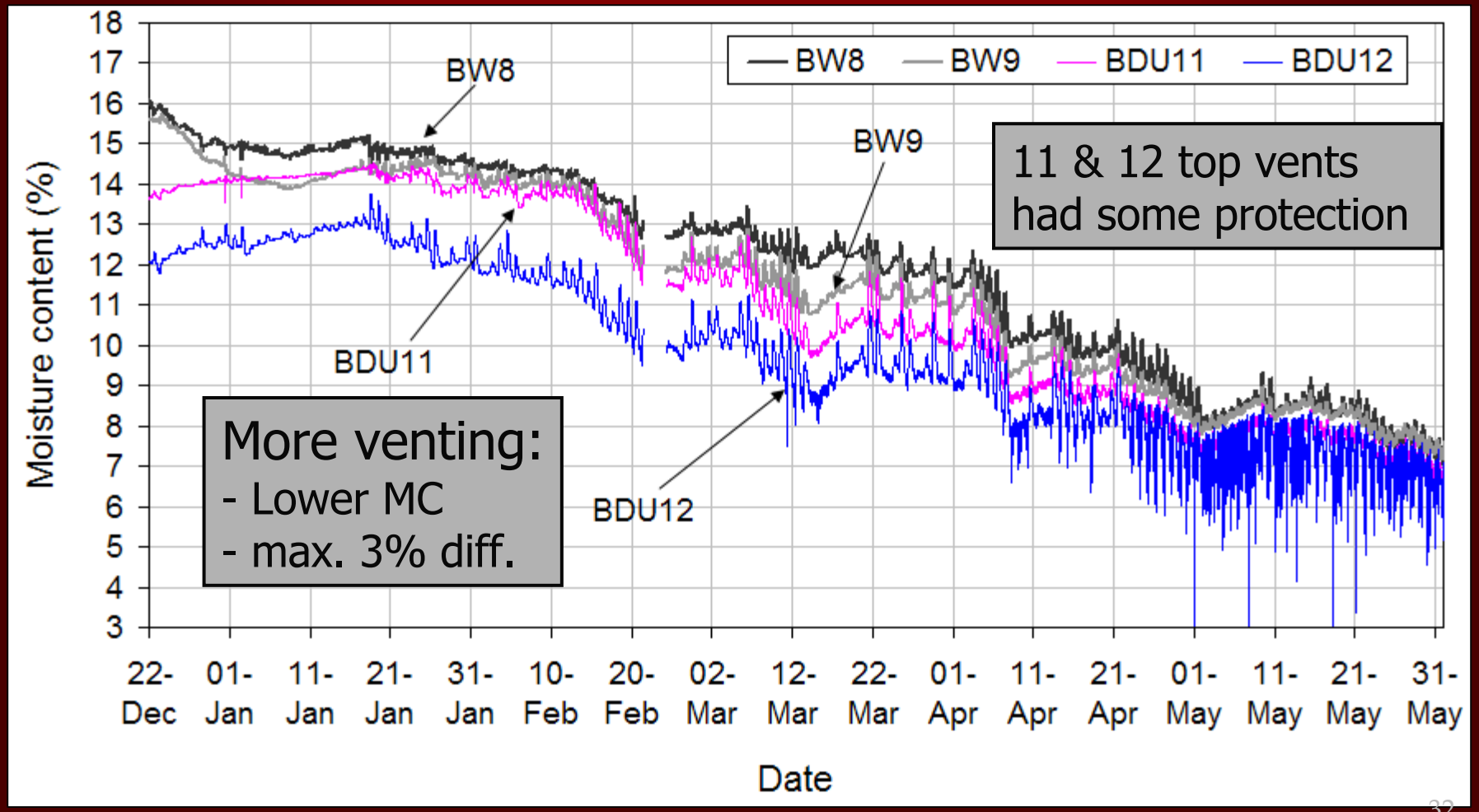


Results and Discussion

Moisture content meas

Comparison of vent configurations for all 1-storey panels





Results Summary

1. High solar radiation during a winter sunny period had a significant influence on the drying of plywood sheathing.

2. Maximum average MC of sheathing for all the dry panels was below 19% during the 2008 wetting season. The pre-wetted panels managed to dry below 19% MC in:
   * 80 days for the panel with top vents.
   * 120 days for the panel without top vents

3. During the 2009 winter period, the panels with one-storey high cavities had slightly lower moisture contents than the panels with two-storey high cavities.

4. For the one-storey high panels, the larger vent configurations had slightly lower moisture contents.

Acknowledgements

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- *Masonry Institute of B.C.*
- Instructors and students from *School of Construction and the Environment* at BCIT

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Conclusions

- Cavity ventilation does help drying brick veneer wall systems under BC's coastal climate, but the significance depends on the moisture level in the walls, vent configurations and weather conditions.
- Top vents help to dry walls with high initial sheathing moisture content (better able to handle a wall defect?).
- For walls with normal initial sheathing moisture content, the effect of ventilation with top vents is positive, but relatively small.
- All of the walls reached similar moisture contents of about 10% by the end of spring.

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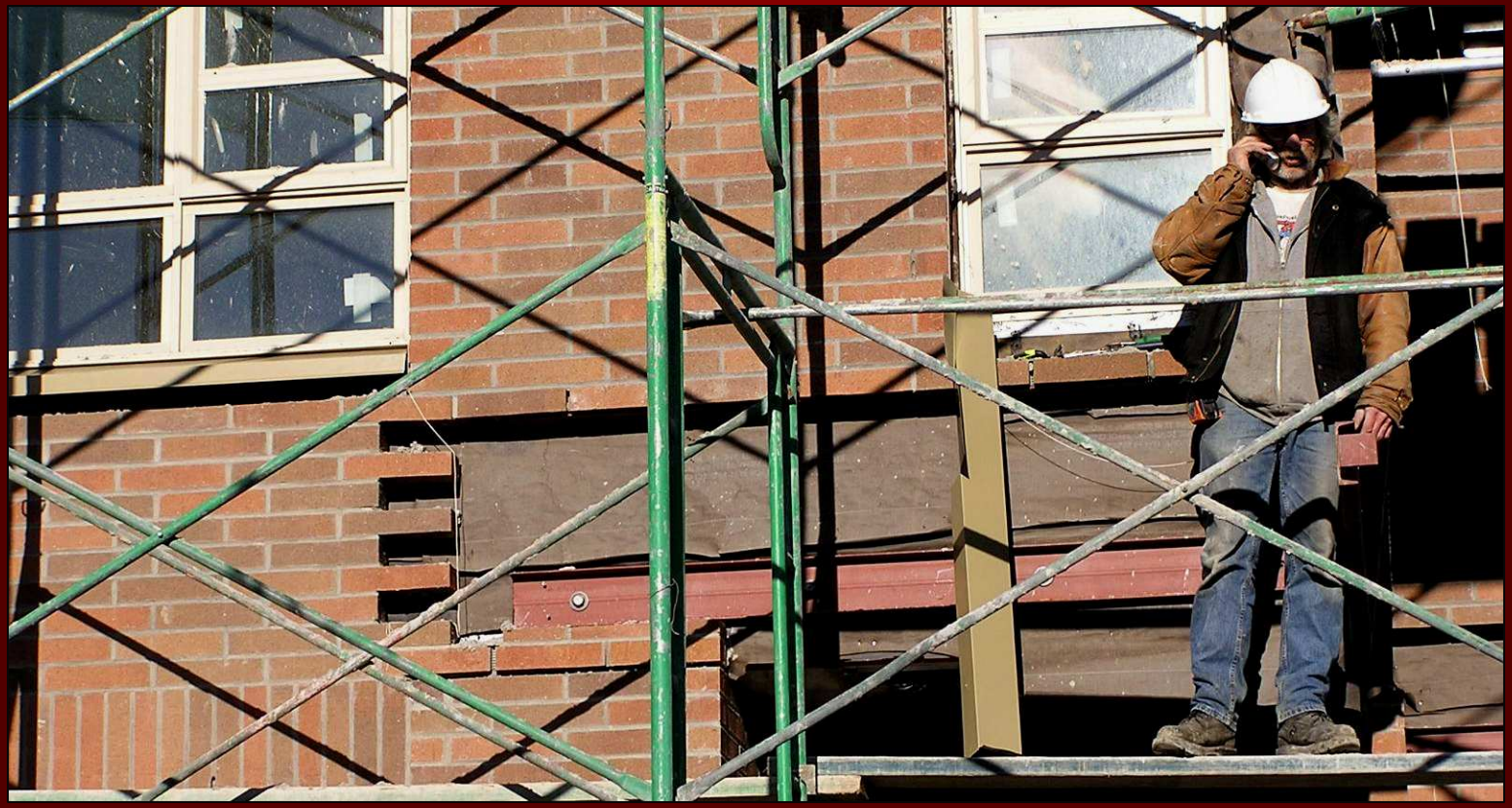
Further Study

- Examine Alternatives:
  - degree of top vent protection
  - water repellants
  - vent devices & configurations
  - cavity widths
  - membranes, insulation
  - masonry cladding & back-up materials
  - wall orientation
- Further years of winter weather patterns.
- Other interior conditions.
- These tests were based on 2-storey walls – it would be worthwhile to explore performance in **higher buildings.**

Bricklayer calling Envelope Specialist:

"I'm concerned about the wall's ventilation capacity to control inward vapour drive without vent devices at the top of the cavity."



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Thank You - Questions ?

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