

Approach to Assessing Continuous Insulation Products

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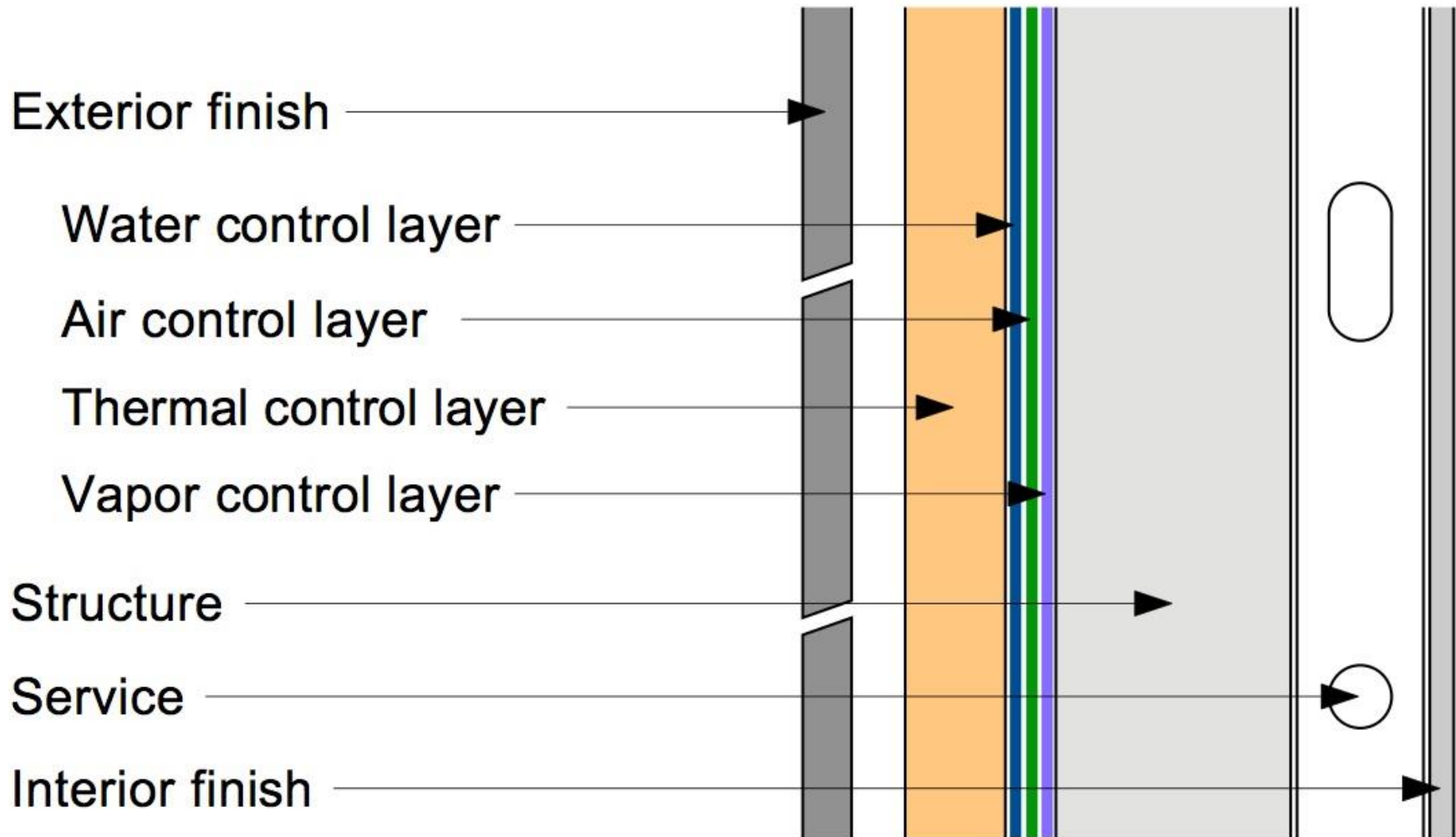
Outline

- Continuous exterior insulation
- Evaluating building systems
- Example of new innovation

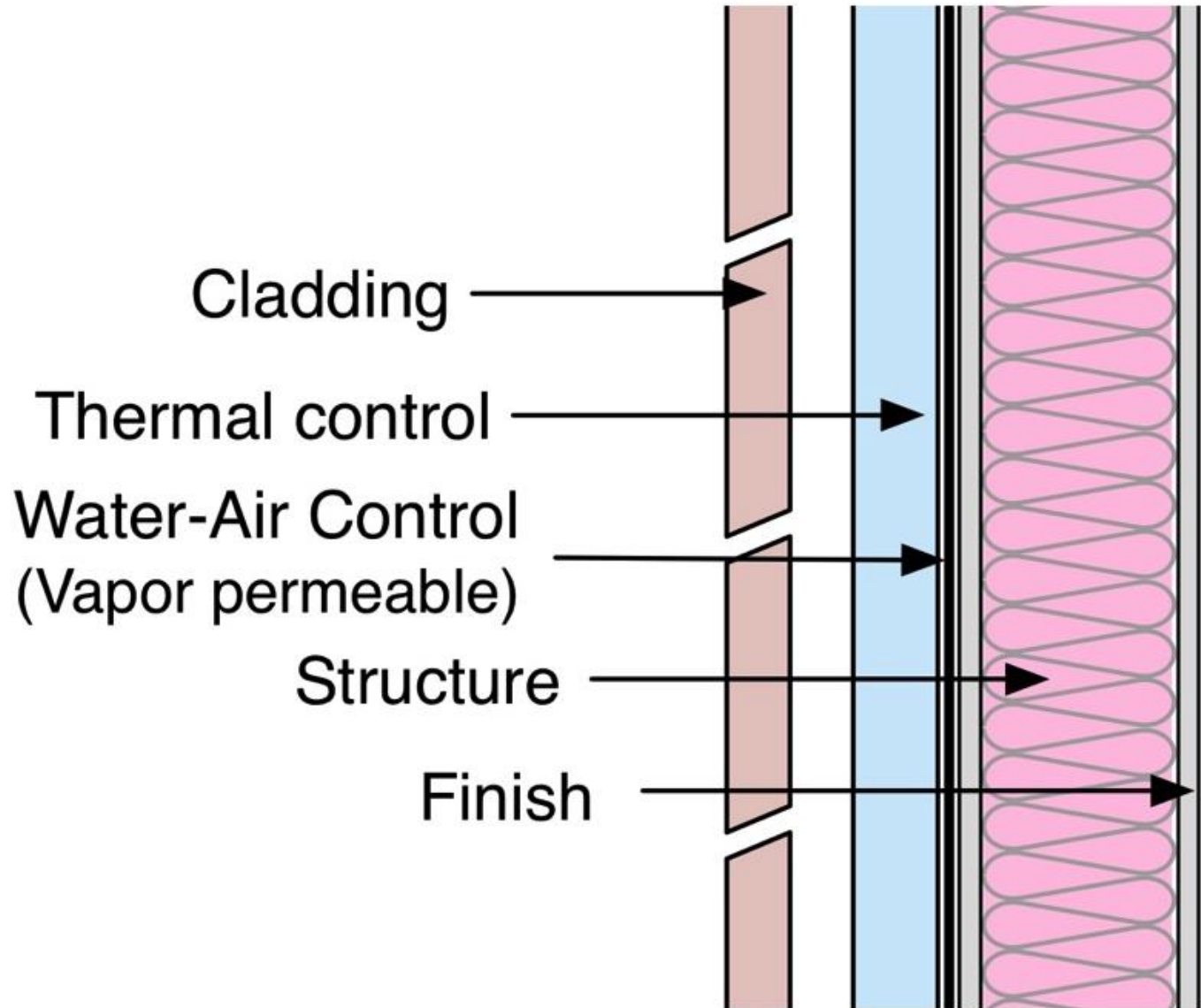
Continuous Insulation

- Exterior insulation becoming more important
- Many advantages:
 - improved thermal performance,
 - protection of more sensitive components
- Many existing products can be used
- Some new products being developed to respond

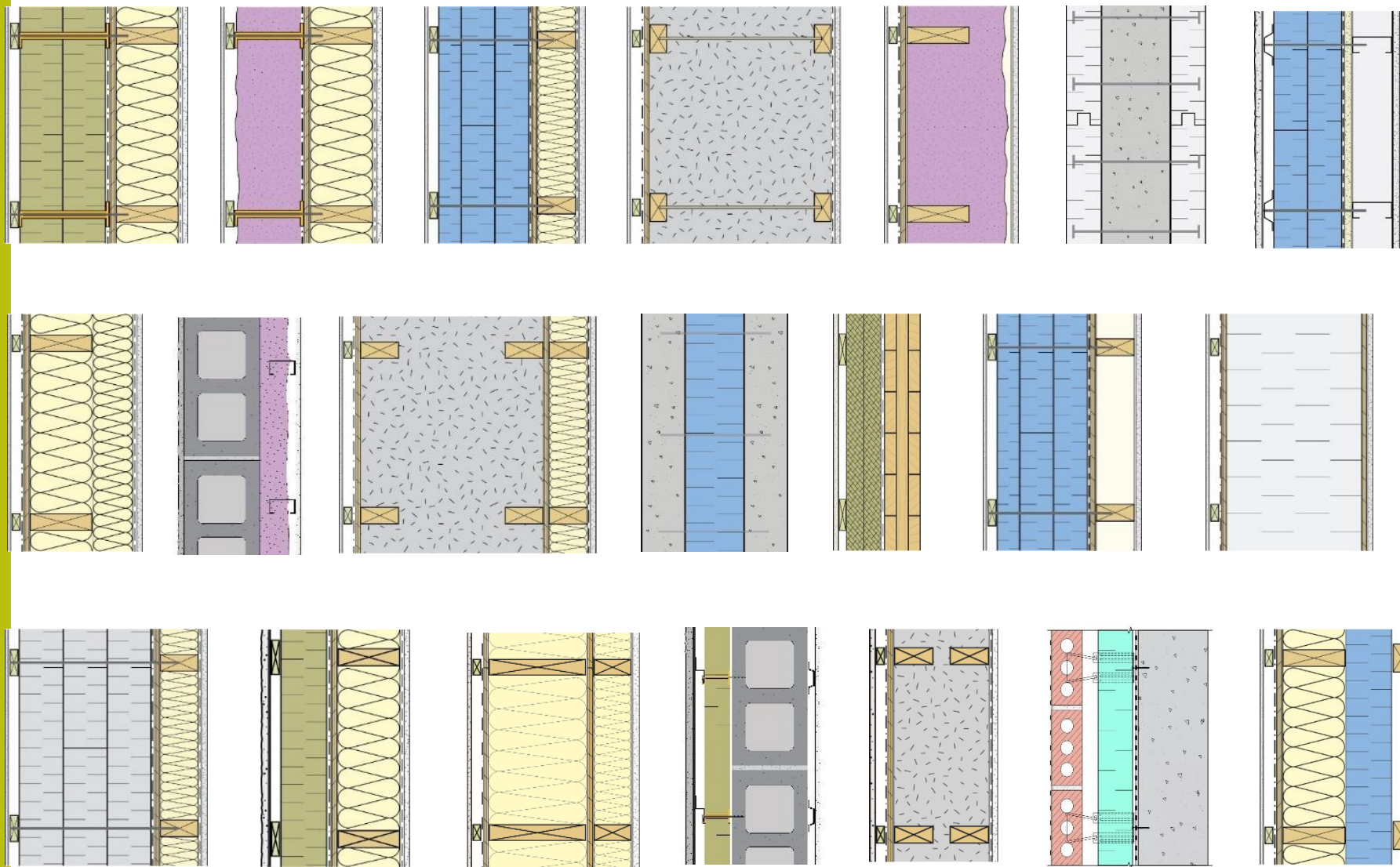
Perfect wall



Wood Framing Compromise



More than One Way to Get There...





Exterior Air Barriers

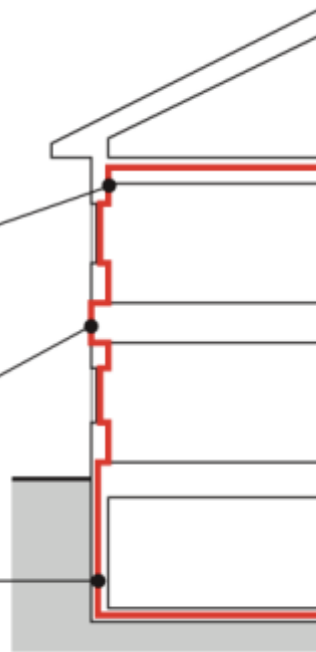
- Many more penetrations and details with interior air barrier approach
- Exterior is preferred today

Interior Air Barrier Approach

■ Interior connection to air barrier at ceiling/attic floor

■ Complex transition at floor and interior walls

■ Connection to below-grade air barrier components

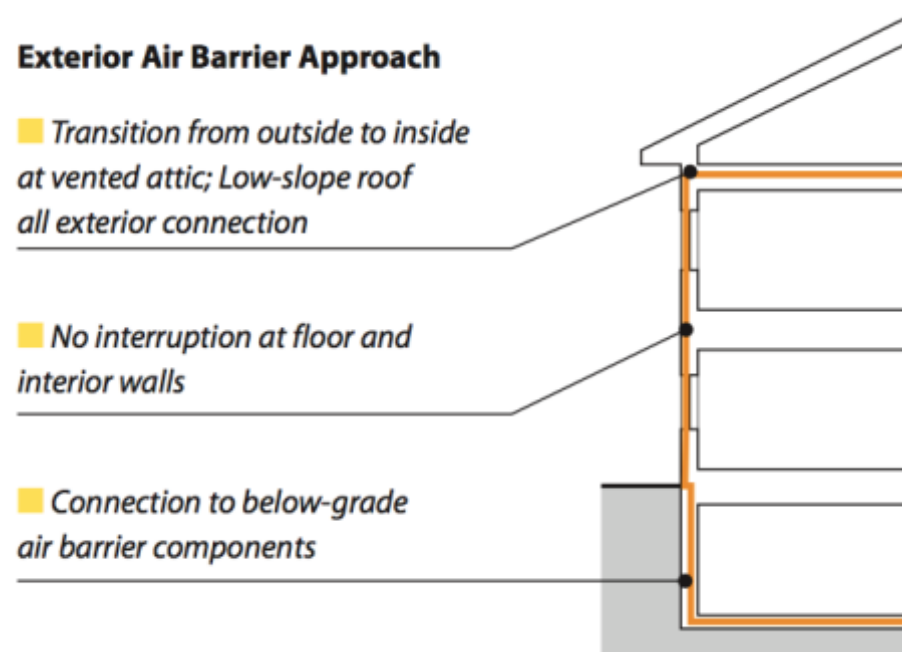


Exterior Air Barrier Approach

■ Transition from outside to inside at vented attic; Low-slope roof all exterior connection

■ No interruption at floor and interior walls

■ Connection to below-grade air barrier components

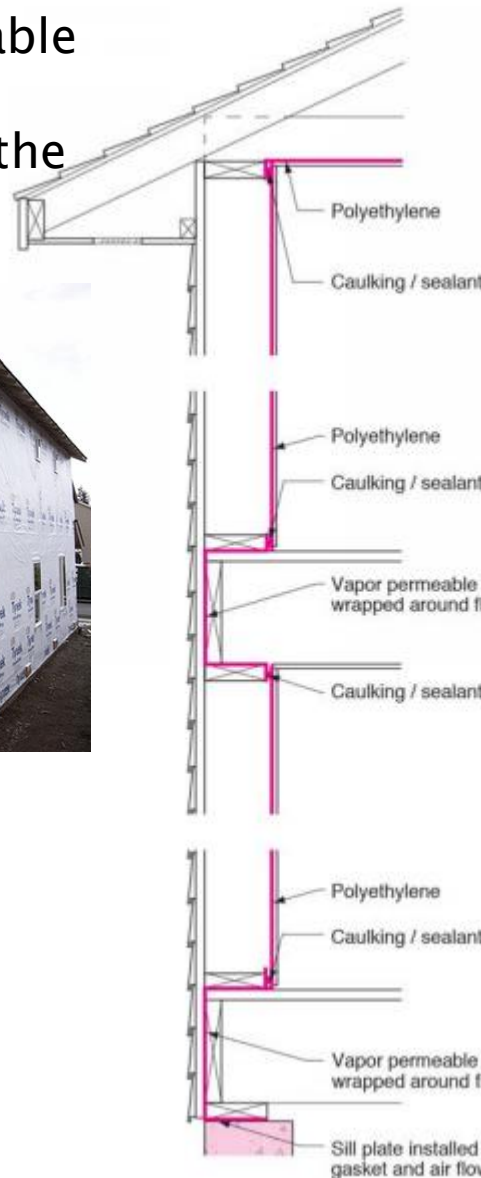
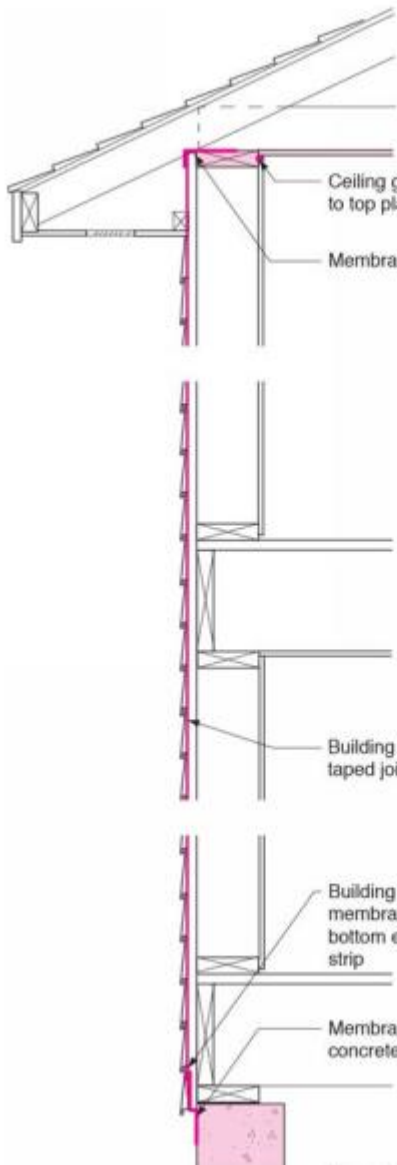


Why Exterior Air Barriers?

Vapor permeable air barriers developed in the 1980s

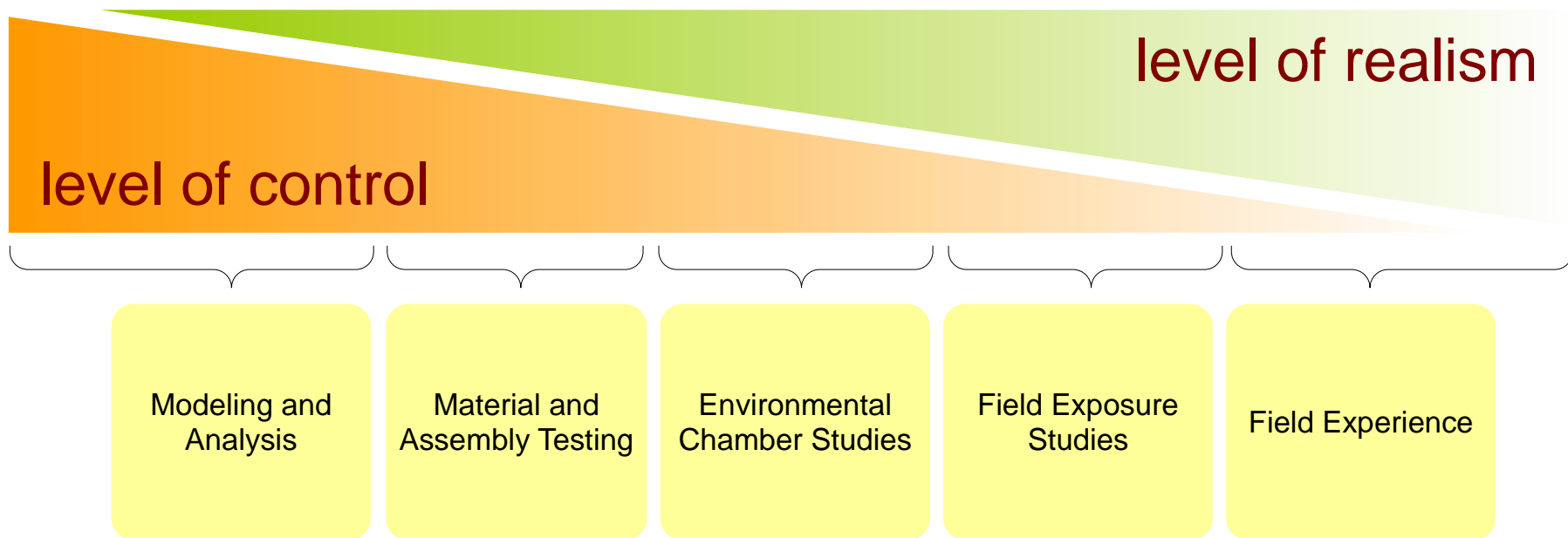
Vapor barrier air barriers first deployed in 1960s

NOT IN HOT-HUMID CLIMES!



Development Process

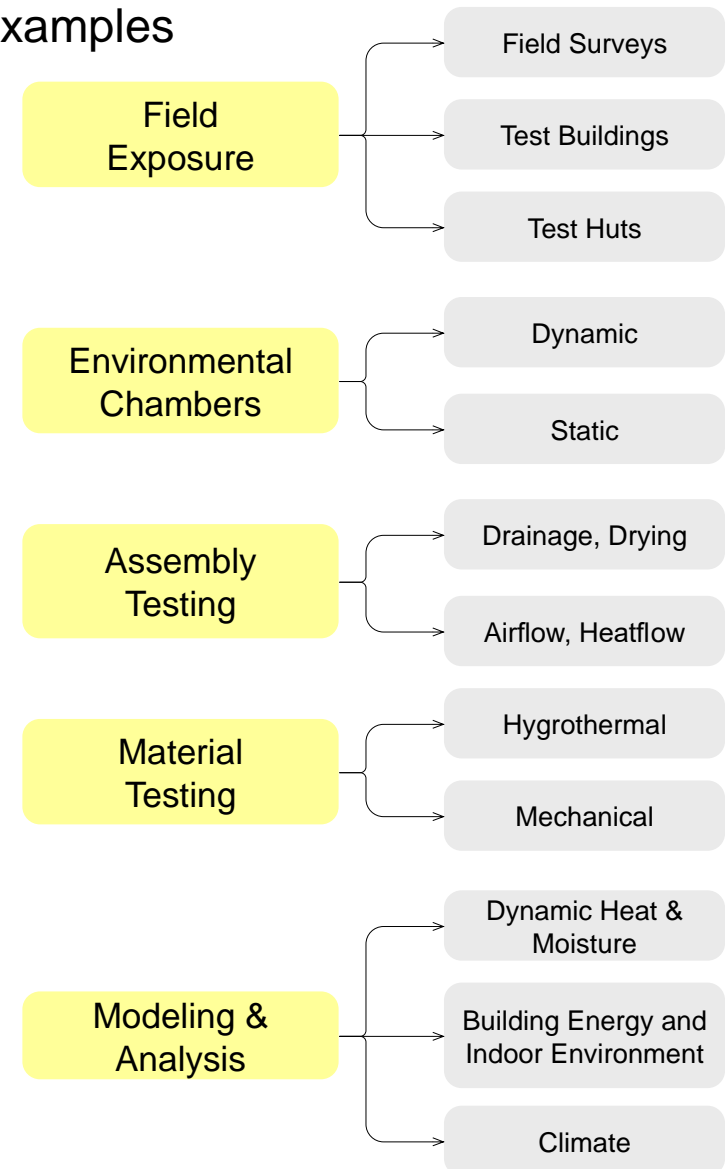
- Many methods for evaluation of building product and systems
 - ... each has its place



Development Process

- Common Methods
 - Lab material tests
 - Hygrothermal modeling
 - Environmental chambers
 - Test huts
 - Test buildings

Examples



What does c.i. need to do

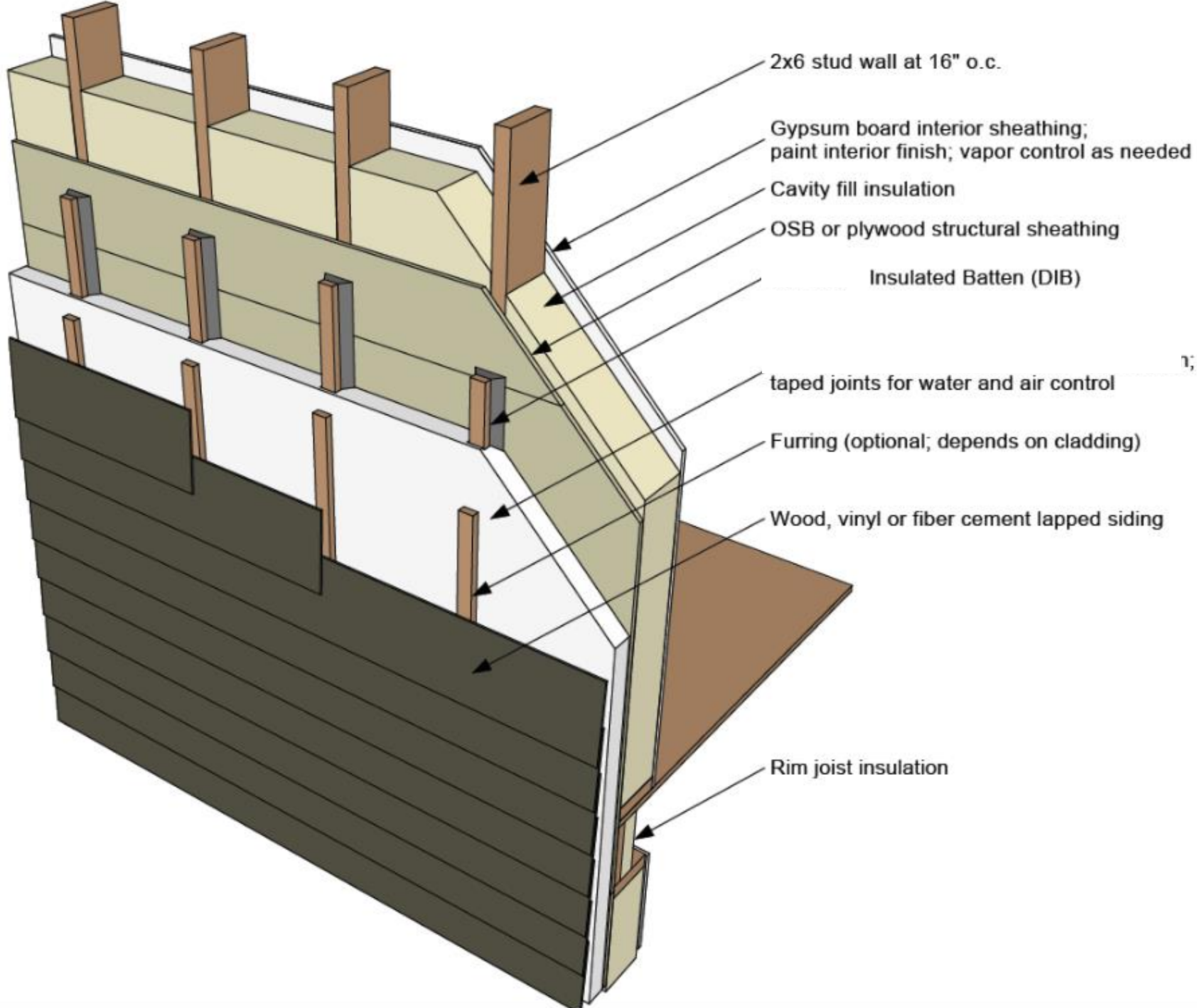
- Design requirement for c.i. vary
- *Much more than just insulation!*
- All must
 - Provide thermal control
- Optional properties
 - **Vapor** open or vapor resistant
 - **Moisture** tolerant or protected
 - **Fire** resistant or combustible

Emerging products

- Some c.i. products perform additional functions
 - Part of cladding attachment?
 - Rain Control System (WRB)
 - Air Barrier System

Case Study

- Innovative, polymer-based fibre insulation with integrated permeable air-water barrier
- Lightweight, comes on a roll!
- Accessories of tape and battens



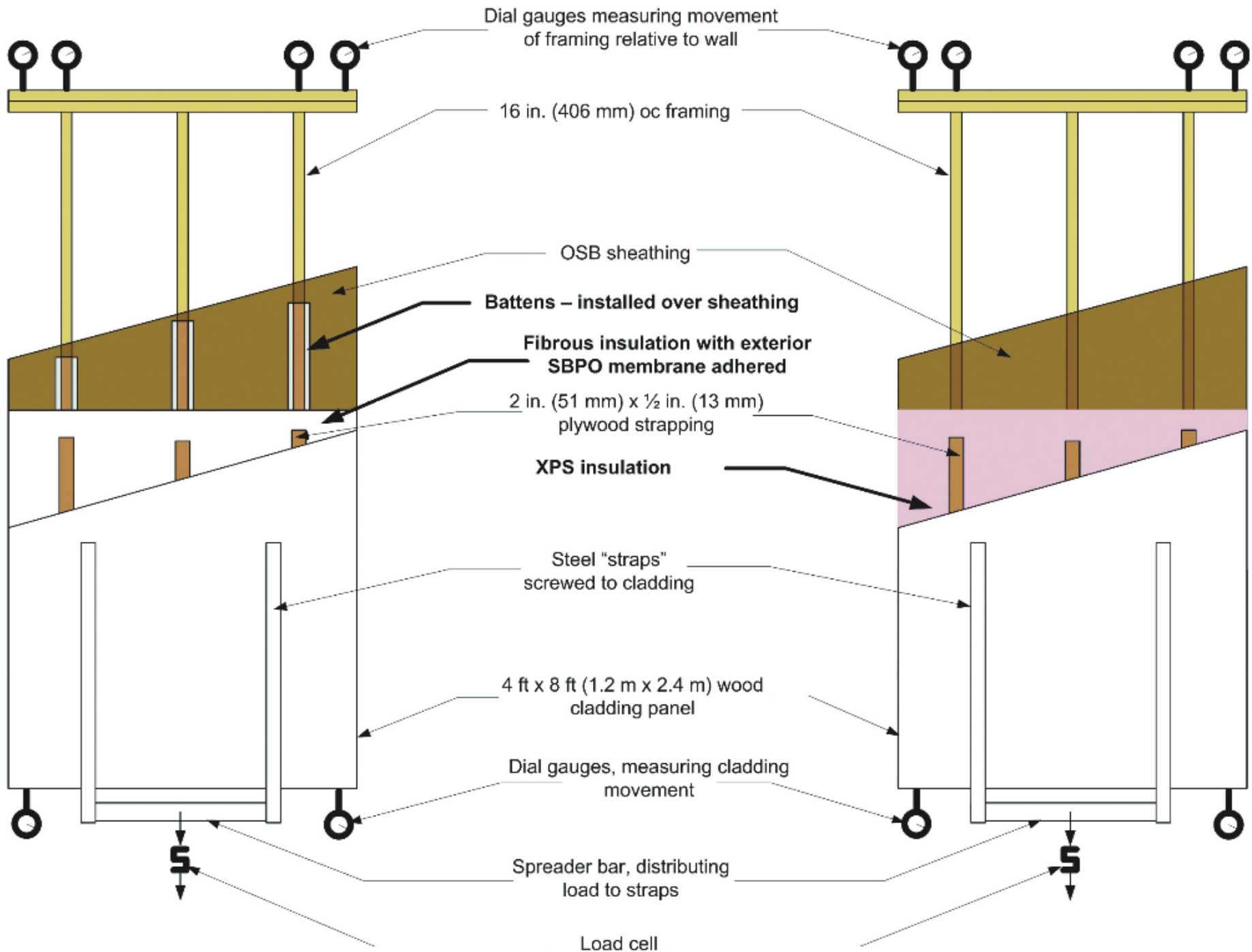
Evaluation

- Standard ASTM testing
 - thermal resistance (C518),
 - air tightness (E2178)
 - Vapor permeance (E96)
 - Water control (E331)
 - Compressive Strength (D1621)
- No standard system level evaluation
 - Cladding support
 - Thermal performance
 - Field hygorthermal

Cladding Weights

- Most cladding for housing is light-weight
- Stucco and Adhered Veneer are heavy

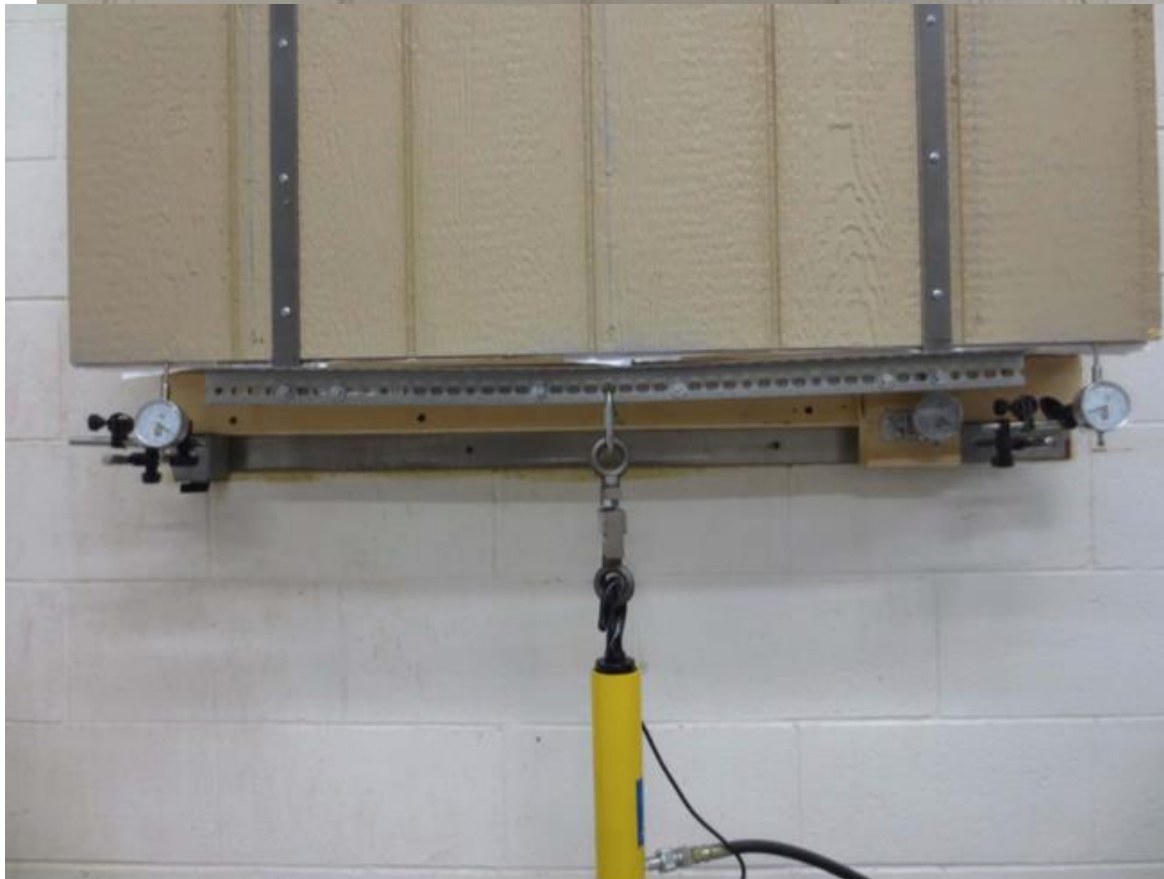
Cladding Type	Typical Mass Density, psf	Equivalent Weight for 4 × 8 ft Test Panel, lb
Vinyl siding	0.6–1.0	20–32
Wood siding	1.0–1.5	32–48
Fiber cement siding	3–5	96–160
Cement stucco	10–12	320–384
Adhered stone veneer	17–25	544–800



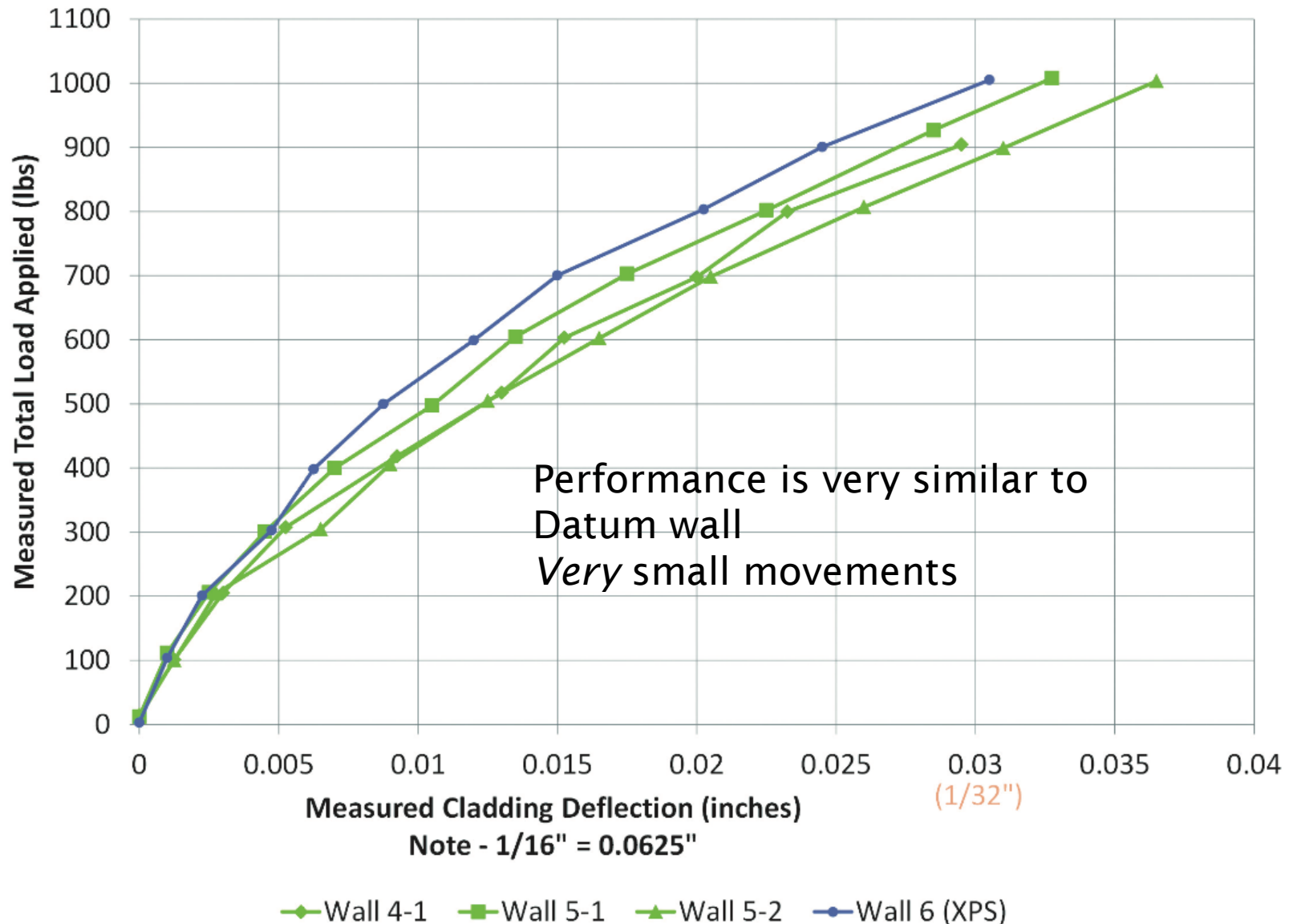


Cladding Support Structural Testing:
Comparison to successful alternate system





Cladding Deflection Tests



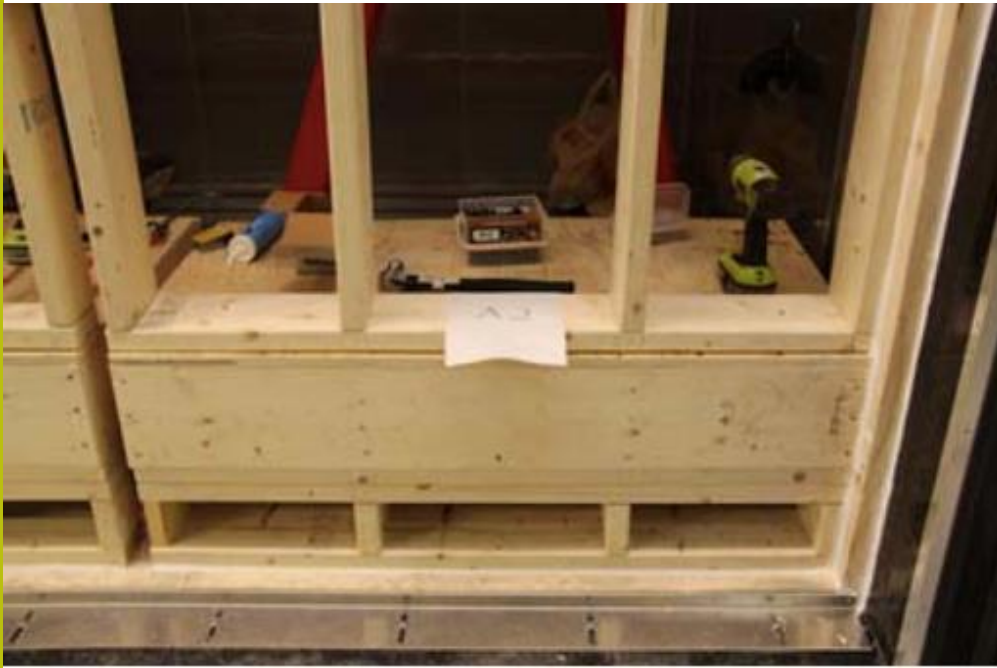
Long-term creep testing

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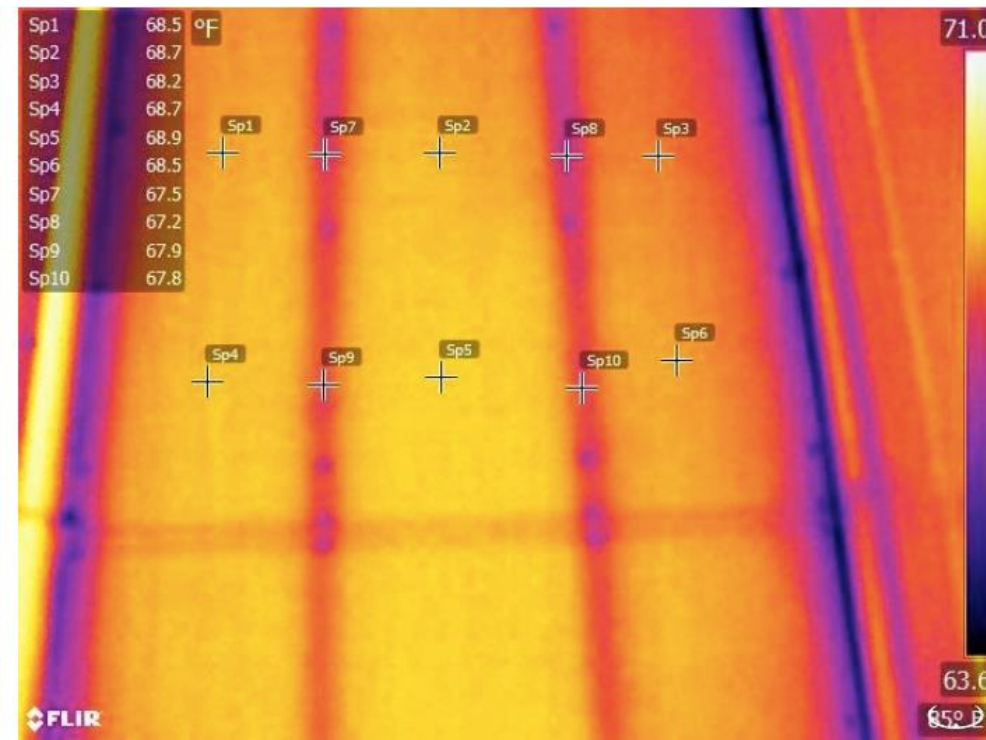
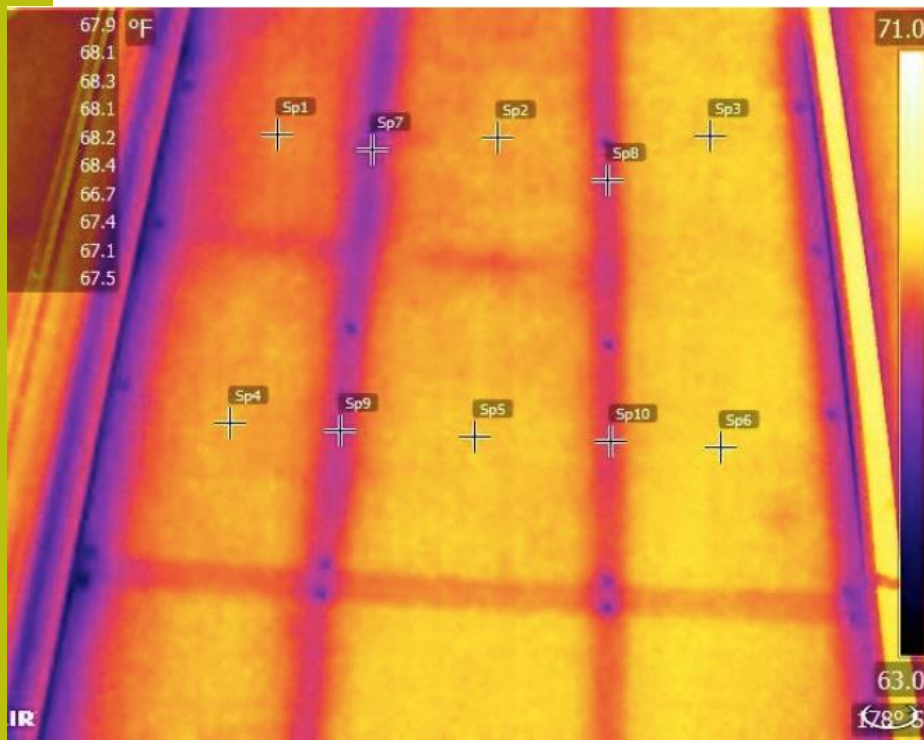
Environmental Chamber

- 20C warm,
-10C cold
- Air pressure
– 0 or 10 Pa



Infra-Red

- Part Demonstration, Part Validation
 - 2x4 with R5 insulation wrap on right
 - 2x6 on left
- 2x4 w/R5 slightly warmer



C1363 Guarded Hot-box





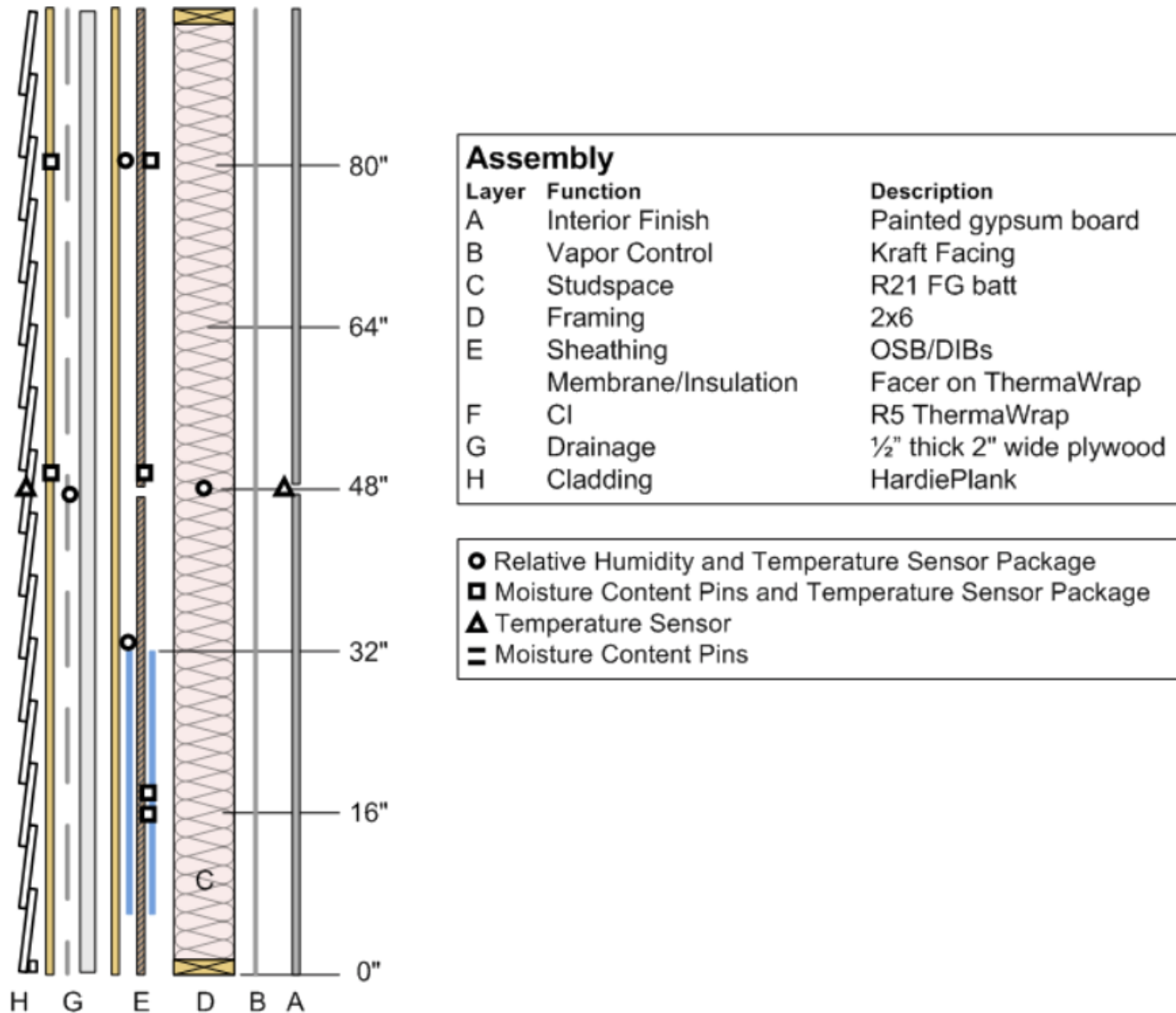
panago

QUILTED TREASURES

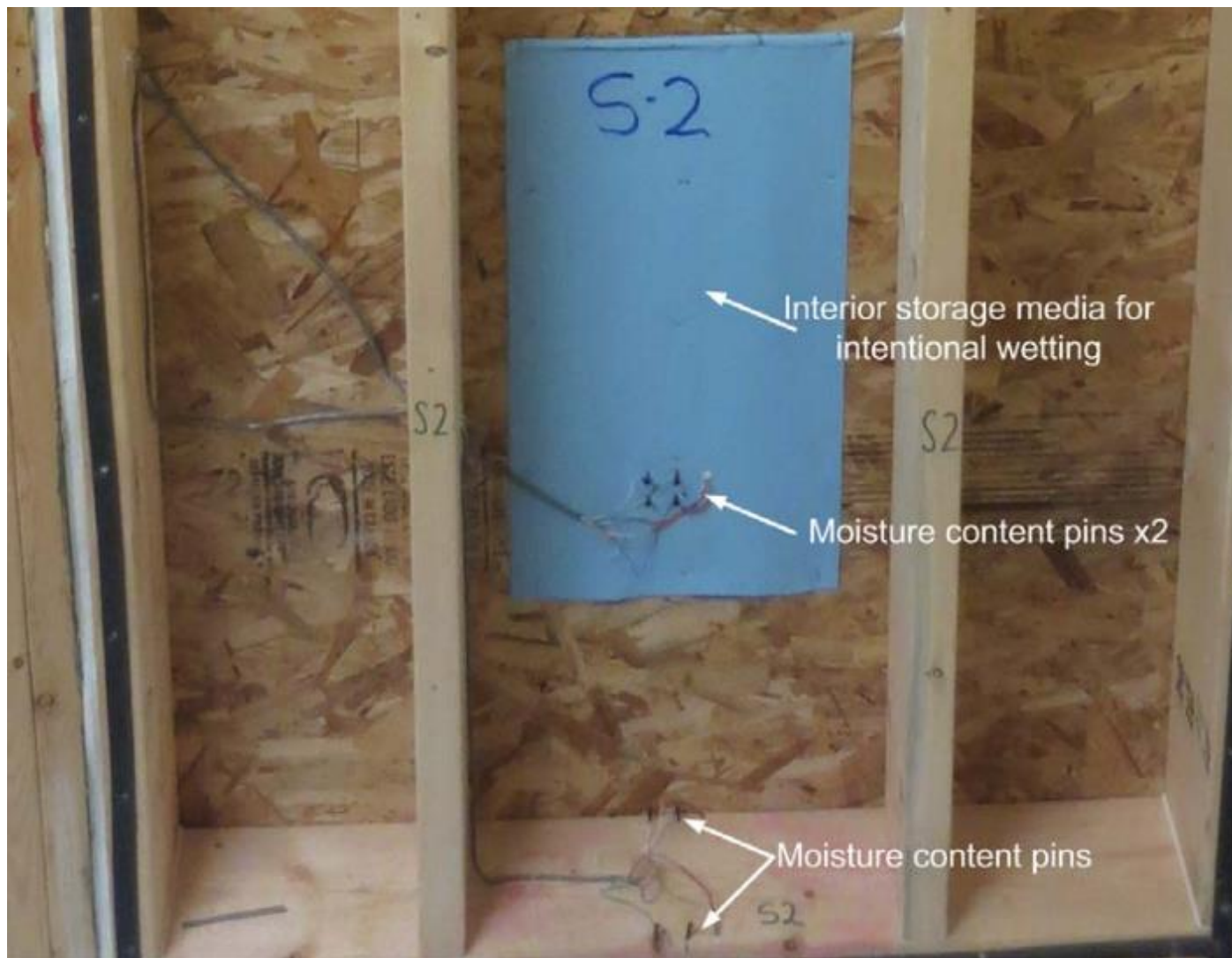
PARKING AT REAR

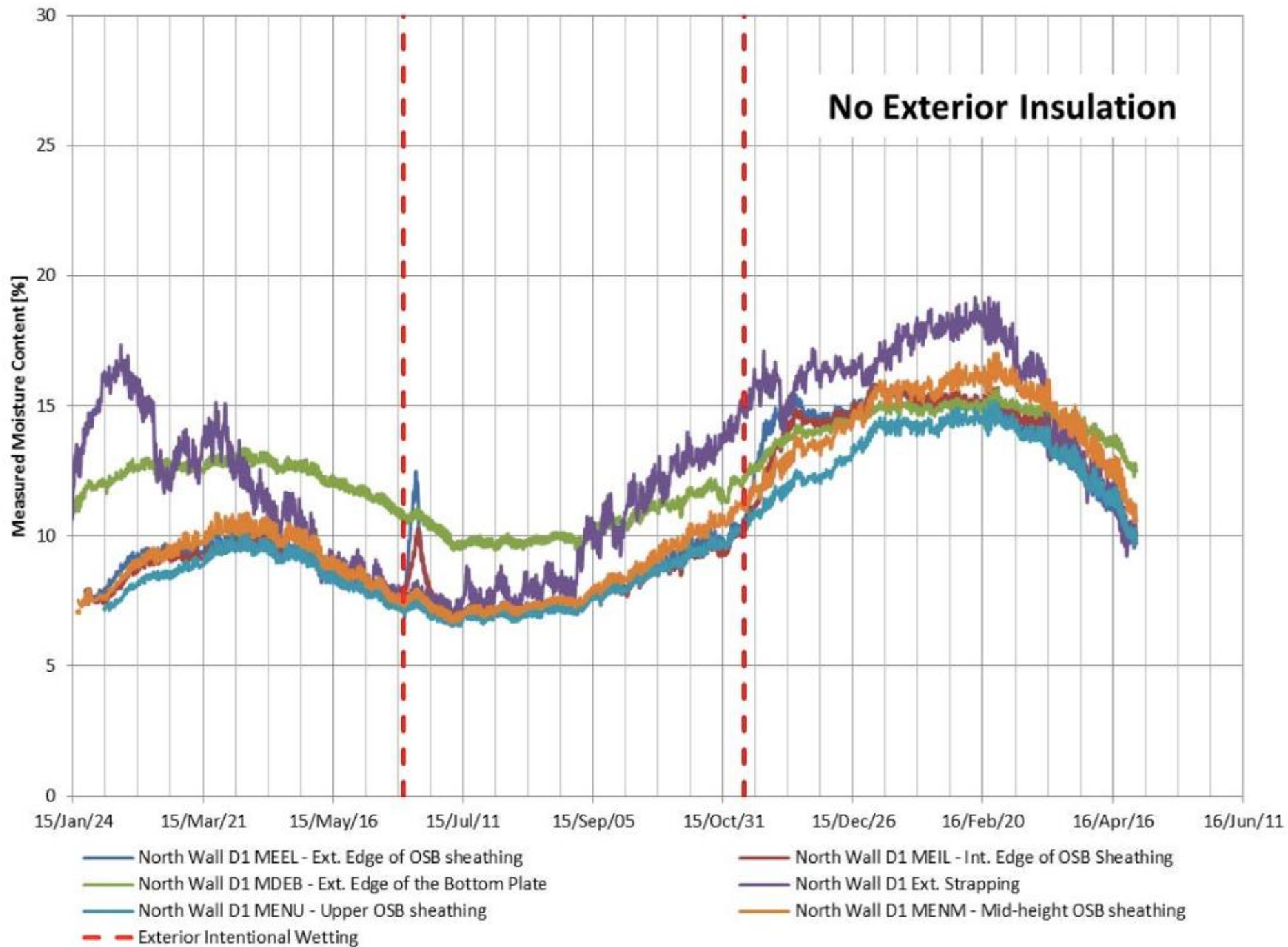


Wall Instrumentation

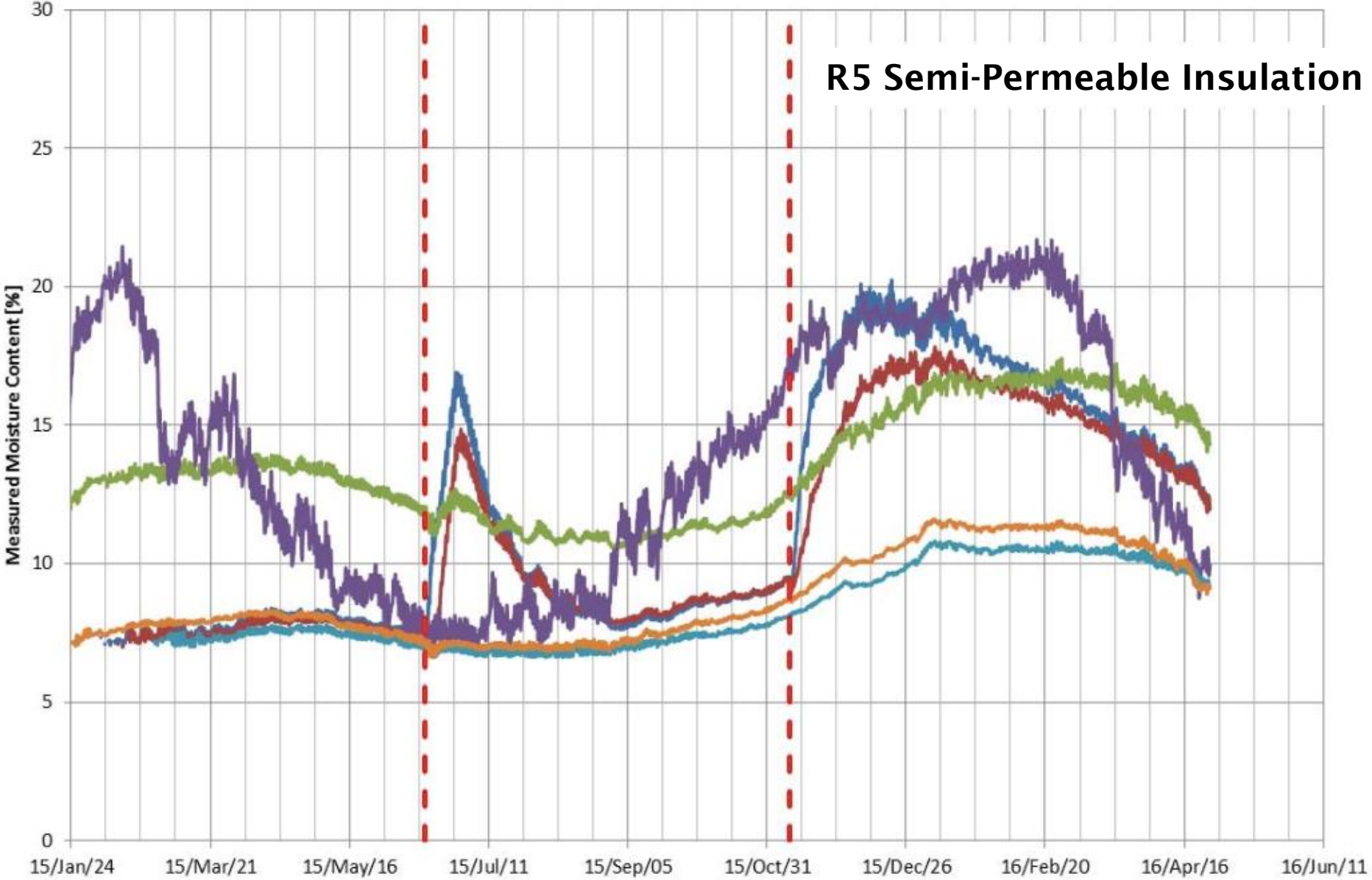


Reproducible Leak



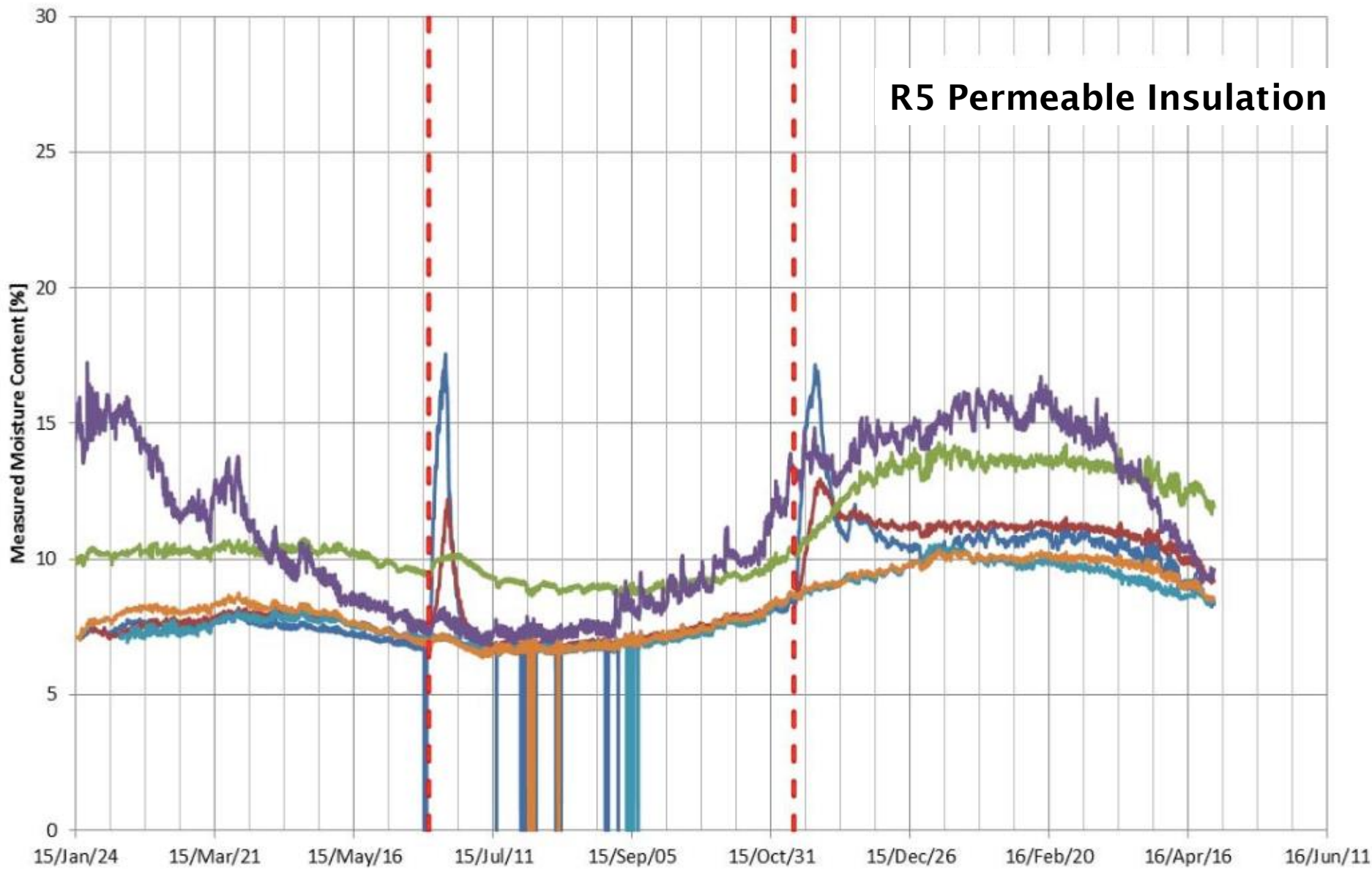


R5 Semi-Permeable Insulation



- North Wall D2 MEEL - Ext. Edge of OSB sheathing
- North Wall D2 MDEB - Ext. Edge of the Bottom Plate
- North Wall D2 MENU - Upper OSB sheathing
- Exterior Intentional Wetting
- North Wall D2 MEIL - Int. Edge of OSB Sheathing
- North Wall D2 Ext. Strapping
- North Wall D2 MENM - Mid-height OSB sheathing

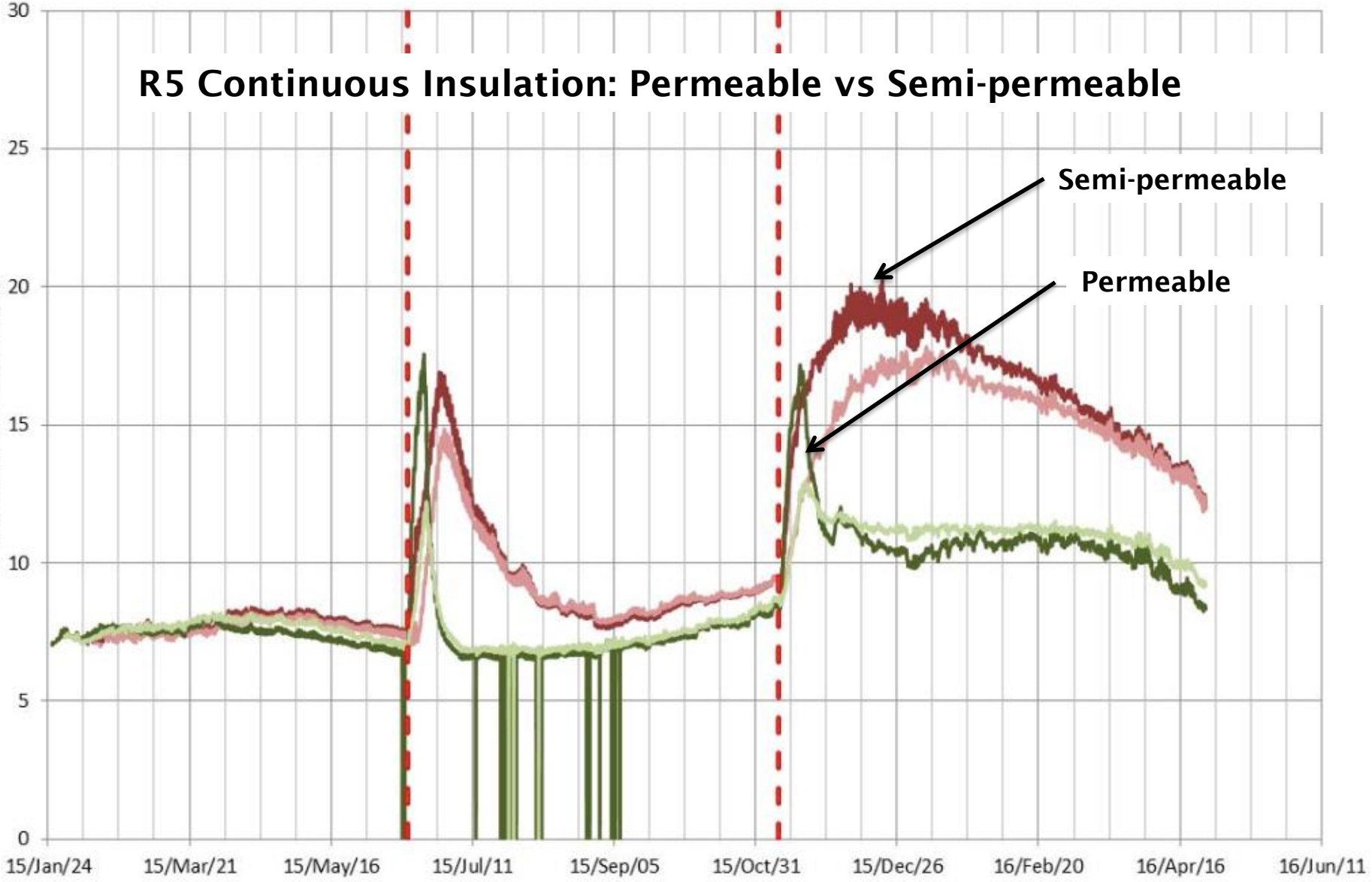
R5 Permeable Insulation



- North Wall D3 MEEL - Ext. Edge of OSB sheathing
- North Wall D3 MDEB - Ext. Edge of the Bottom Plate
- North Wall D3 MENU - Upper OSB sheathing
- North Wall D3 MENM - Mid-height OSB sheathing
- North Wall D3 Ext. Strapping
- - Exterior Intentional Wetting

R5 Continuous Insulation: Permeable vs Semi-permeable

Sheathing MC (w%)



Semi-permeable

Permeable

- R5 XPS Ext. Insulation - Sheathing MC (Dark Red)
- R5 XPS Ext. Insulation - Sheathing MC (Light Red)
- R5 ThermaWrap - Sheathing MC (Green)
- R5 ThermaWrap - Sheathing MC (Light Green)
- - - Intentional Wetting Event (Red Dashed)

Conclusions

- Continuous insulation product innovation will continue
- Standard testing useful, but custom system-level testing often required
- Load testing demonstrates even flexible insulation can be effective as cladding support
- Permeable exterior insulation is very forgiving of moisture events