Durability, Termites, and Moisture

FLORIDA BUILDING ENCLOSURE DESIGN

WOODWORKS, MAY 2019

COLIN SHANE | PRINCIPAL

RDH BUILDING SCIENCE

Copyright Materials

This presentation is protected by US and International Copyright laws.
Reproduction, distribution, display and use of the presentation
without written permission of the speaker is prohibited.

RDH

Making Buildings Better

© RDH Building Sciences Inc. 2015

"The Wood Products Council" is a Registered Provider with The American Institute of Architects Continuing Education Systems (AIA/CES), Provider #G516.

Credit(s) earned on completion of this course will be reported to AIA CES for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

This course is registered with AIA CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.

Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

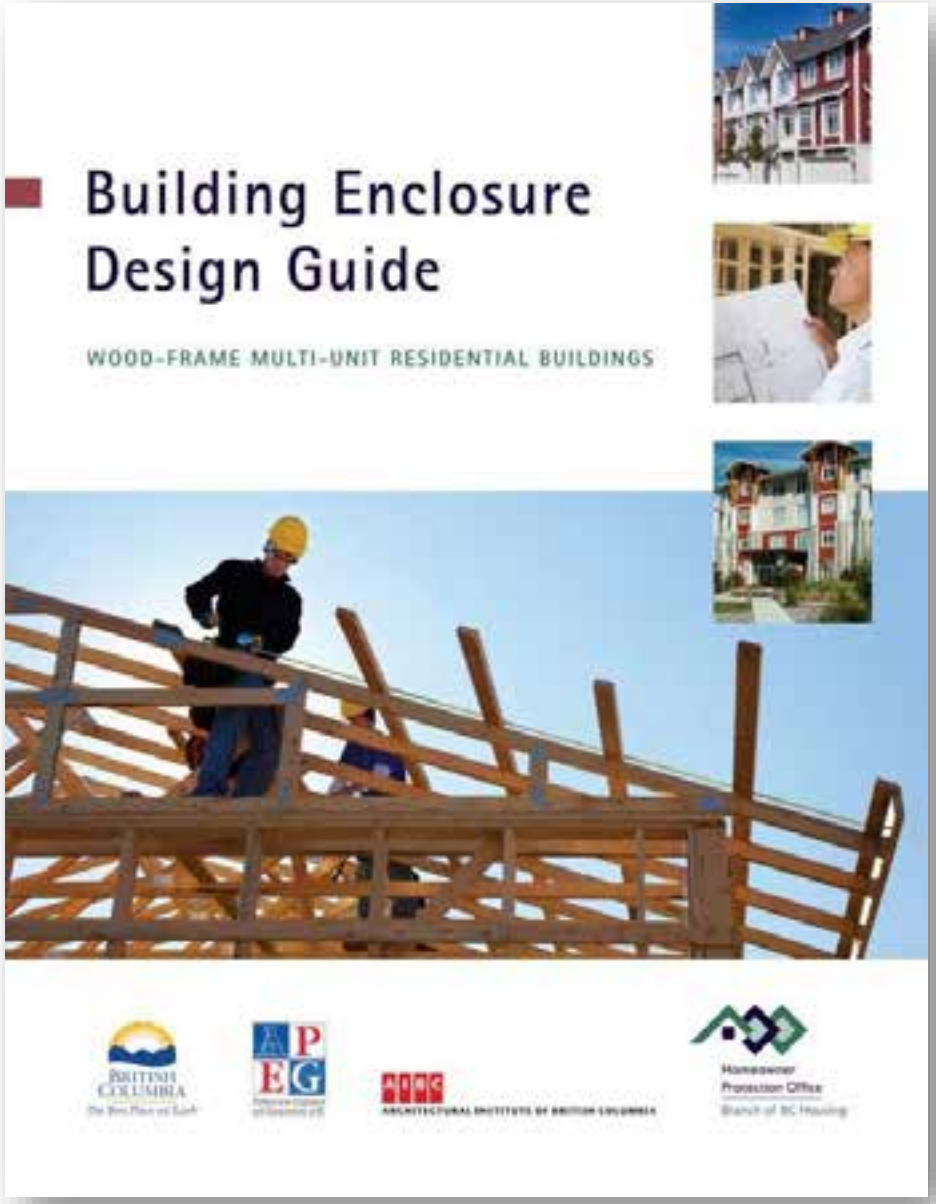
Course Description

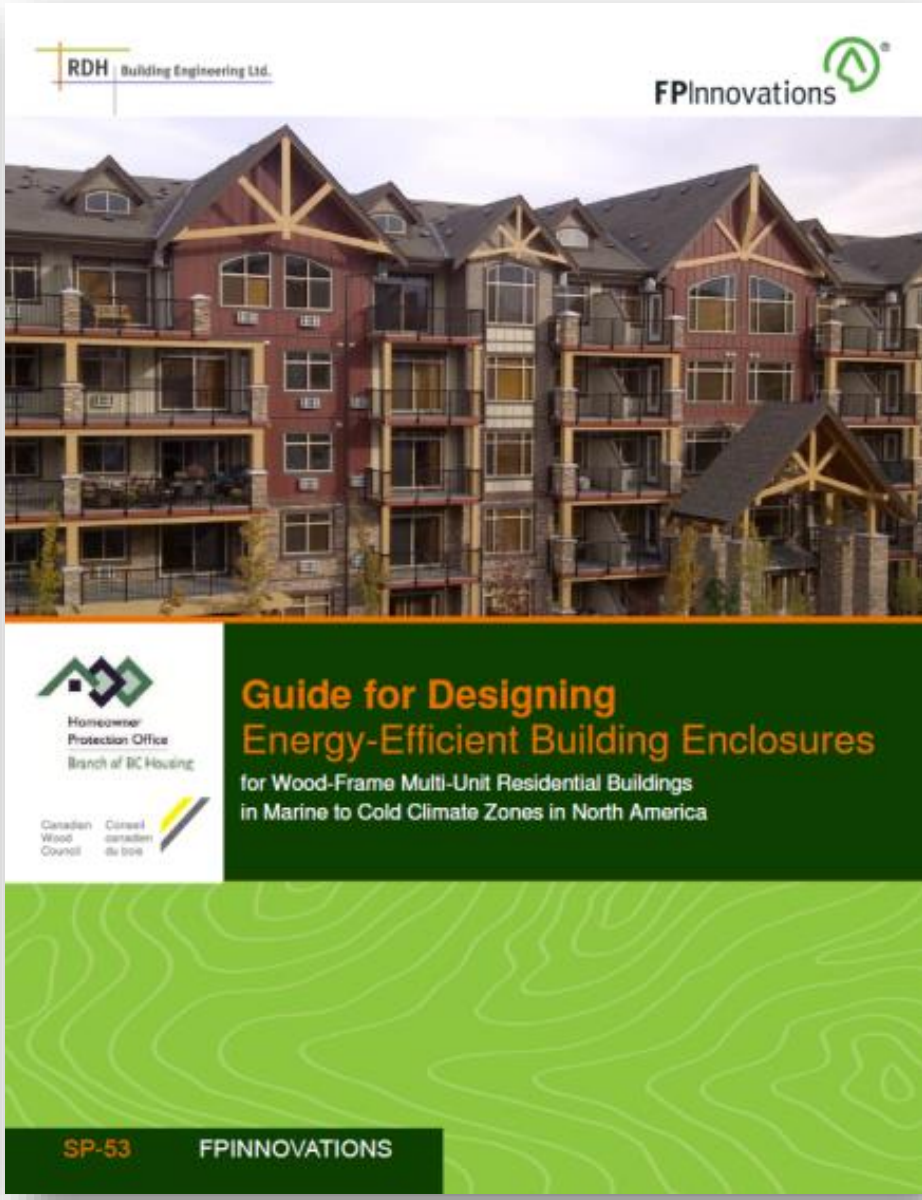
- Building enclosures are responsible for controlling heat flow, air flow, vapor flow and a number of other elements. In Florida, they are also essential for termite prevention. This presentation will explore design considerations associated with wood-frame building enclosures and the role of control layers in addressing items such as durability, termite prevention and control, and thermal continuity.

Learning Objectives

- → Review building science fundamentals and building enclosure design considerations for wood-frame buildings in hot and humid regions.
- → Explore the role of control layers in building enclosures for elements such as heat flow, bulk water intrusion and air flow.
- → Identify the types of termites found in Florida and understand their paths of entry into building structures and the damage they may cause.
- → Understand and apply the termite protection requirements of the Florida Building Code for multi-family and commercial projects.

Wood-frame Building Enclosure Design Guides





Fundamentals

Water, Air, Heat, Vapor… and Bugs

Building Enclosure Design Fundamentals

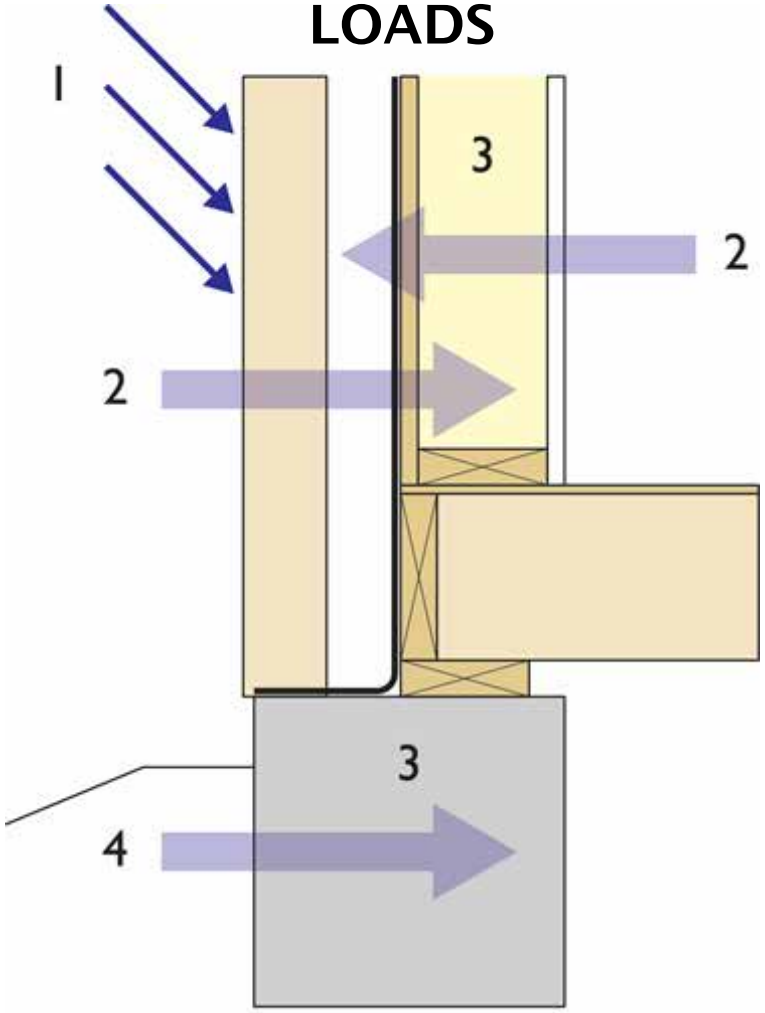
- → **Support**
  - → Structural loads
  - → Structural movements
- → **Control**
  - → Water penetration
  - → Air flow
  - → Vapor diffusion / condensation
  - → Heat flow
  - → Bugs
  - → Light and solar radiation
  - → Noise, fire, and smoke
- → **Finish**

The Old Way

The New Way – “Light & Tight”

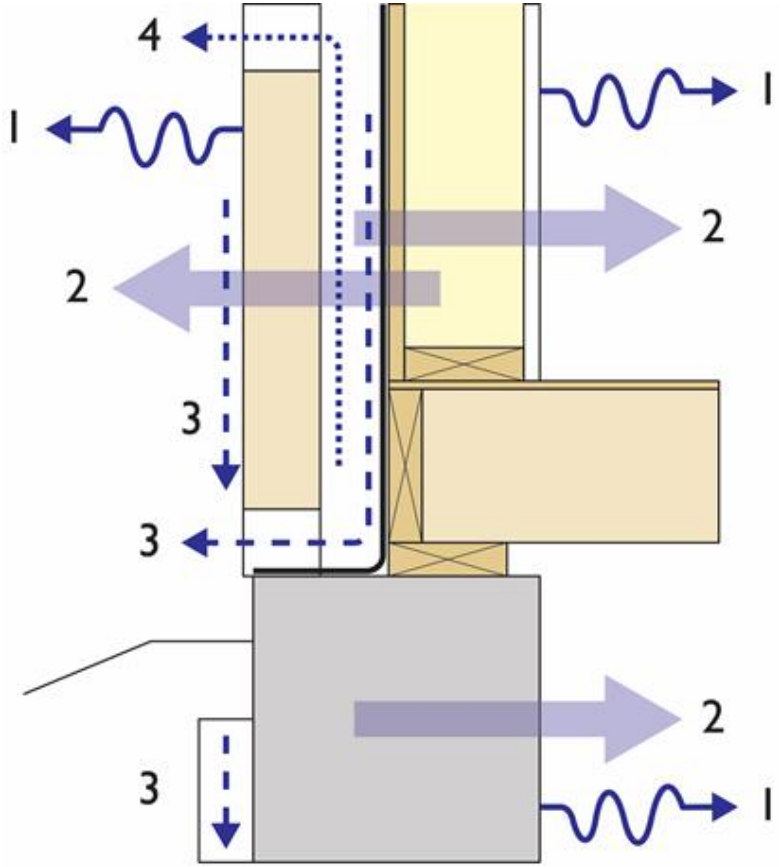
Controlling Water – The Balance

LOADS



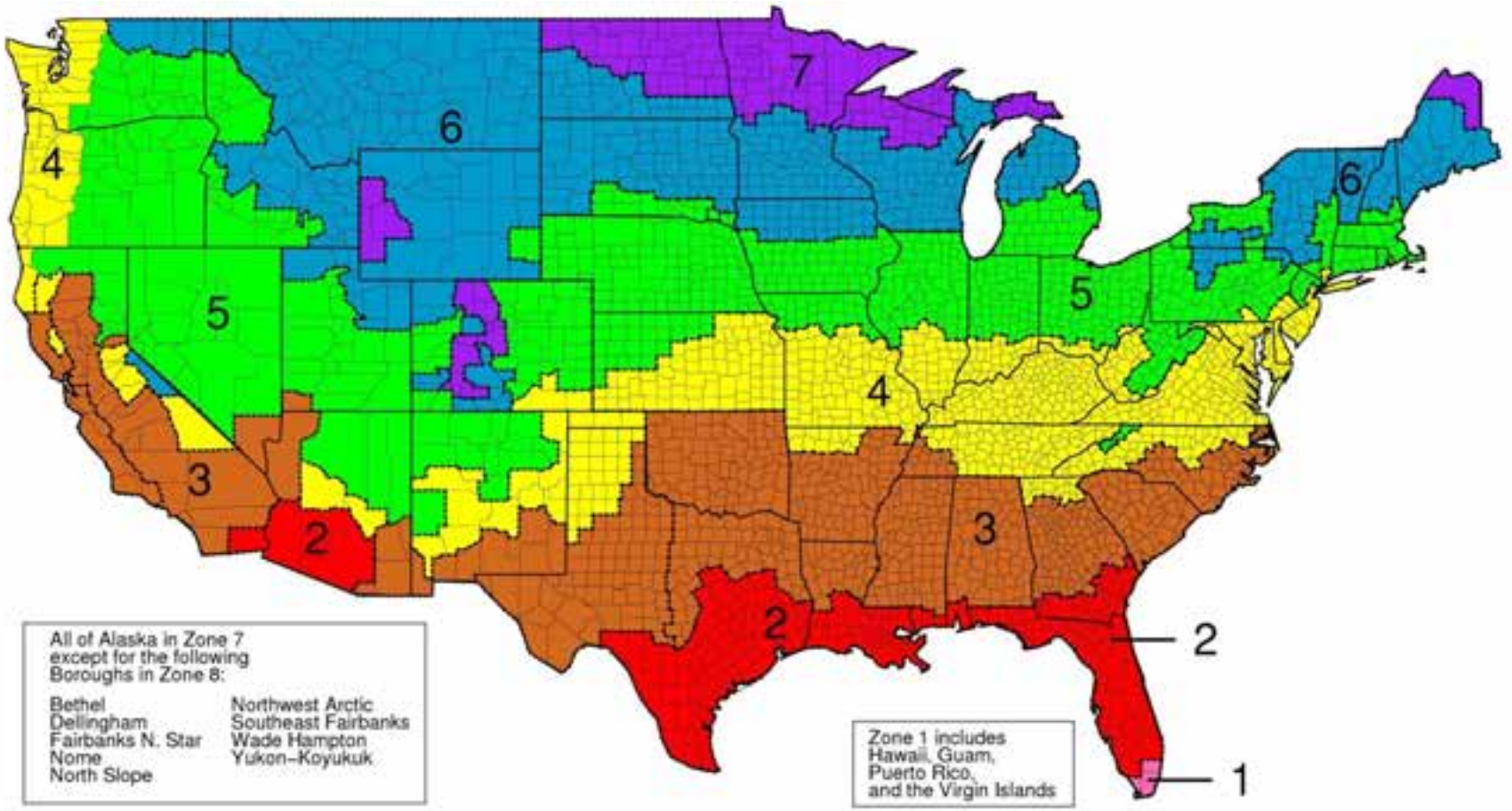
1. Precipitation (rain or snow)
2. Water vapor transported by diffusion and/or air movement (outward or inward)
3. Built-in construction moisture
4. Groundwater

RESISTANCE



1. Evaporation of water at surfaces
2. Water vapor transport by diffusion and/or air movement (outward or inward)
3. Drainage
4. Ventilation drying by air exchange

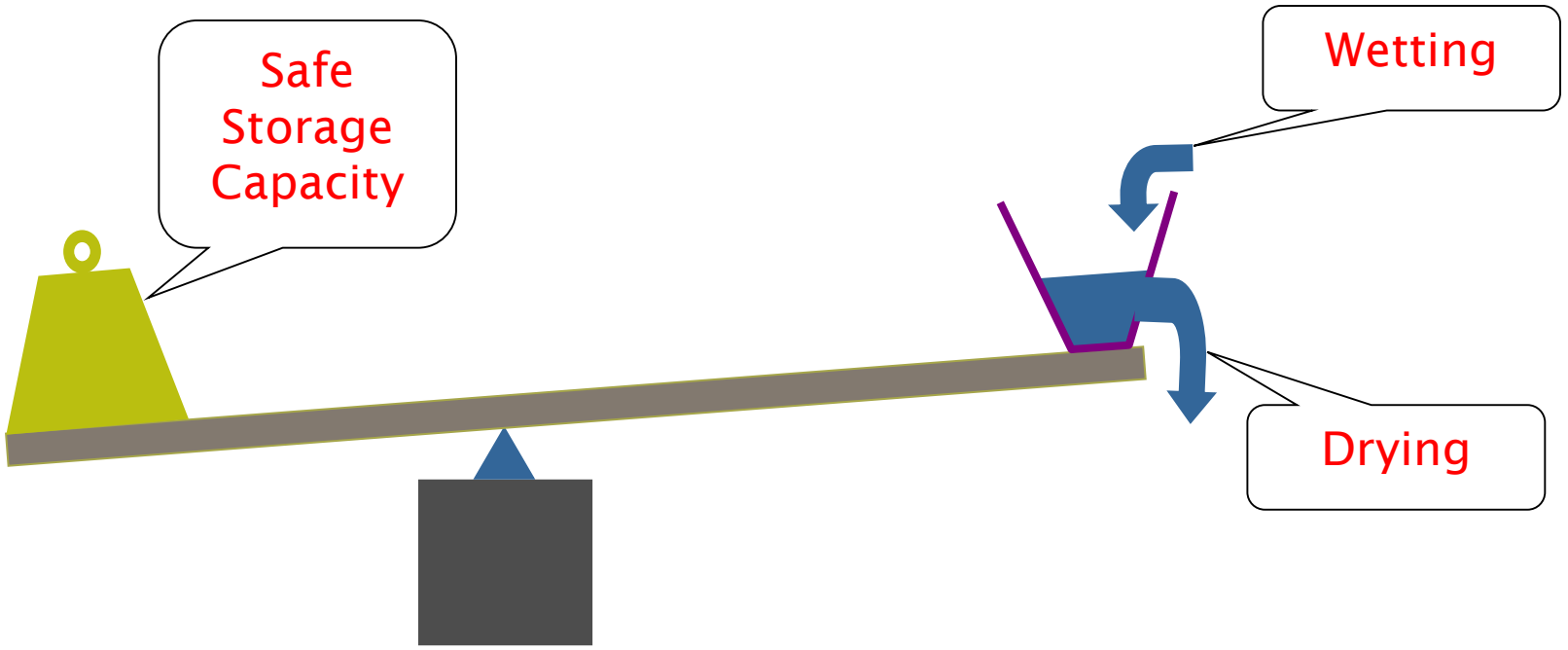
Climate Zones



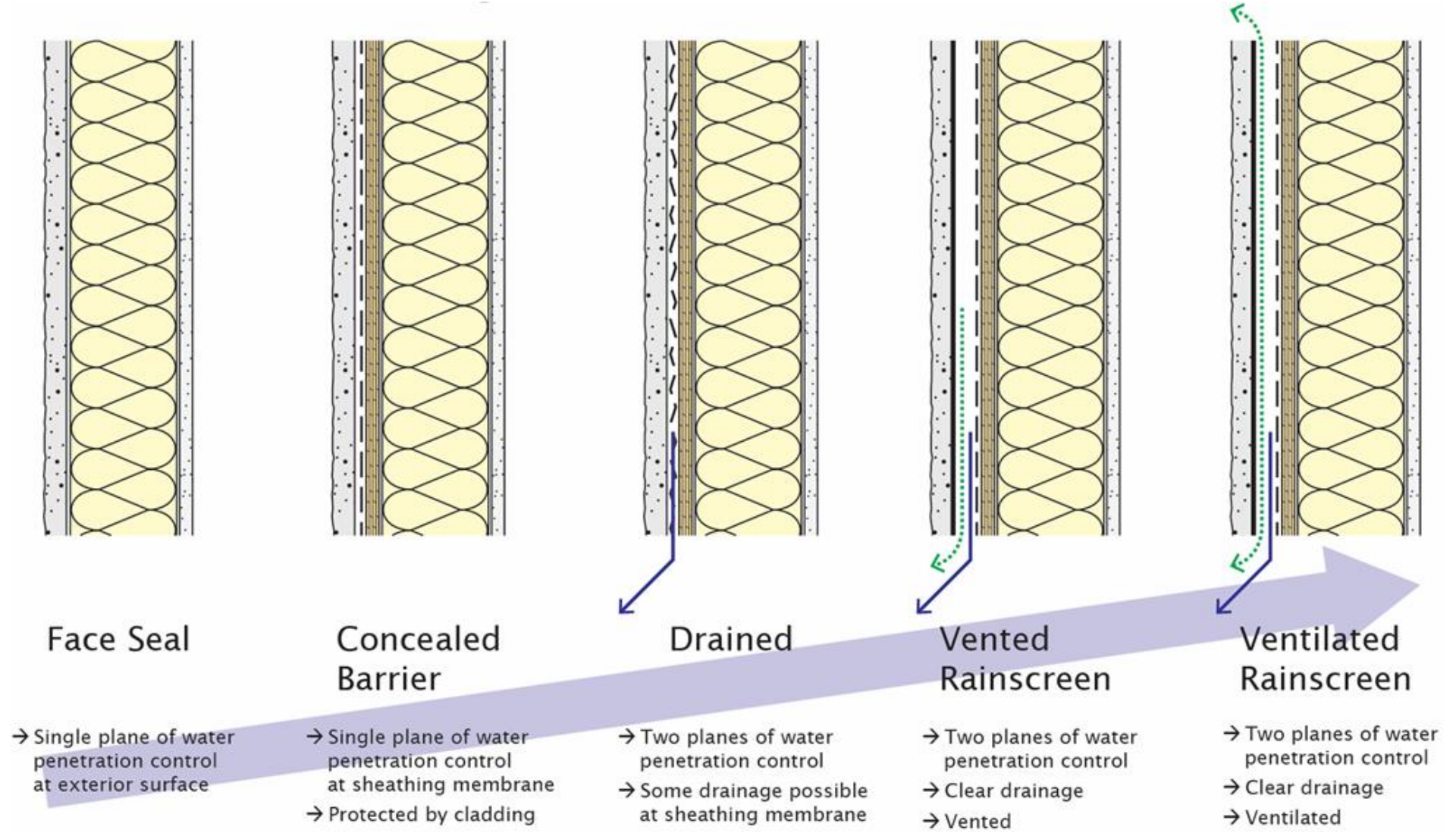
Controlling Water – The Balance

→ Wetting is ok (and inevitable)

→ But not too much or for too long



Water Penetration Control Strategies



Controlling Water – Bulk Rain

→ 2 lines of defense:

→ Water resistive barrier **(WRB)**

→ Water shedding surface **(WSS)**

→ Material choice and amount of drainage between WRB and WSS affect performance

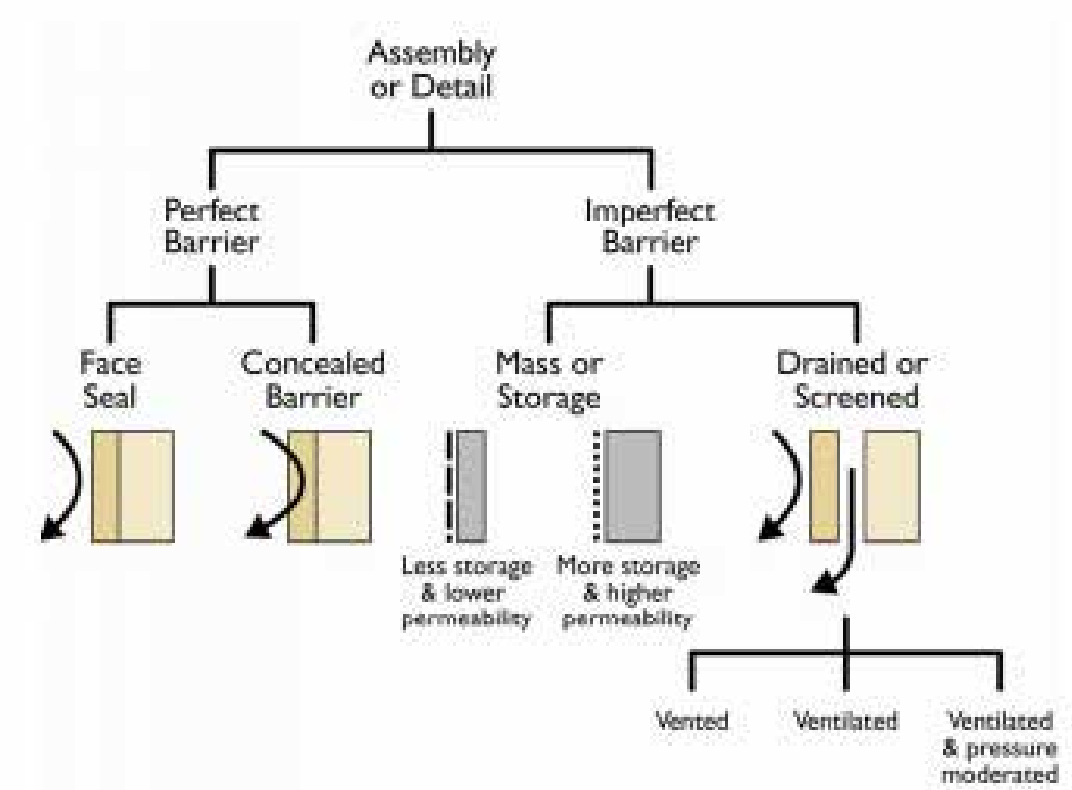
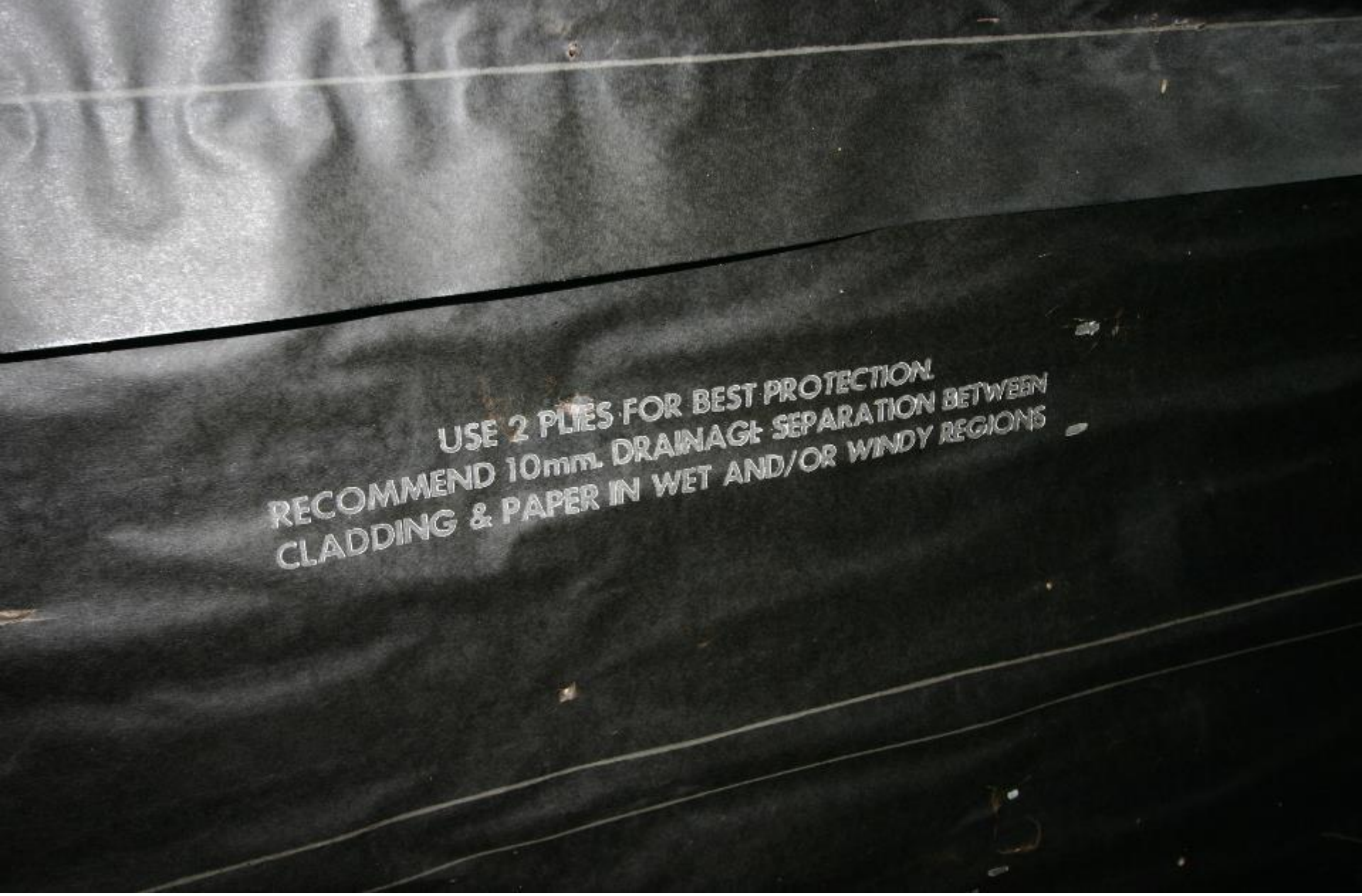


Figure 3-15 Water penetration control strategy classification
(adapted from Straube and Burnett 2005)

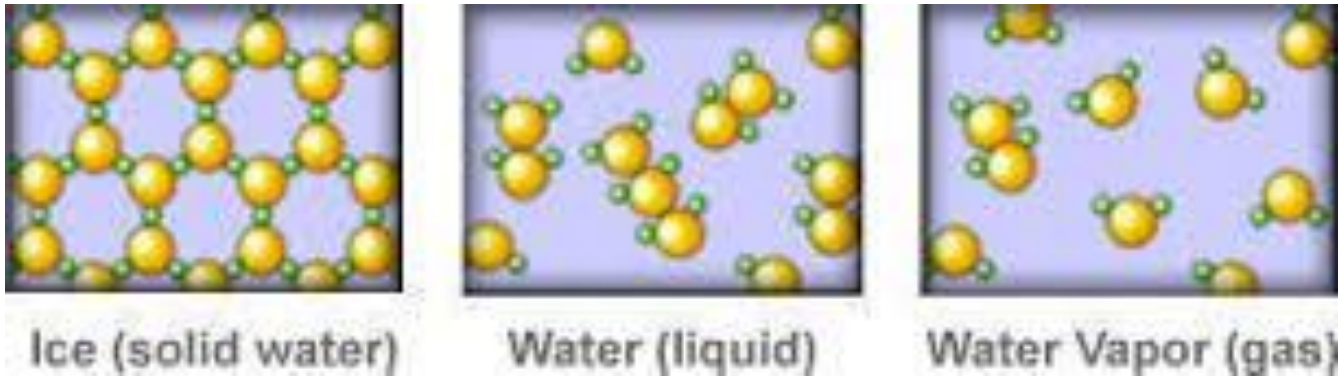

USE 2 PLIES FOR BEST PROTECTION
RECOMMEND 10mm. DRAINAGE SEPARATION BETWEEN
CLADDING & PAPER IN WET AND/OR WINDY REGIONS

Drained / Ventilated Cladding

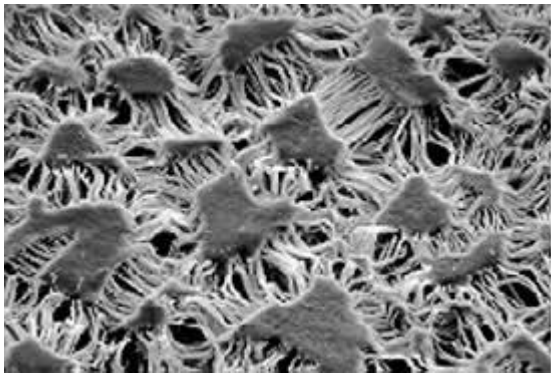
Drained / Ventilated Cladding - Stucco

Air, Vapor, or Water Barrier?

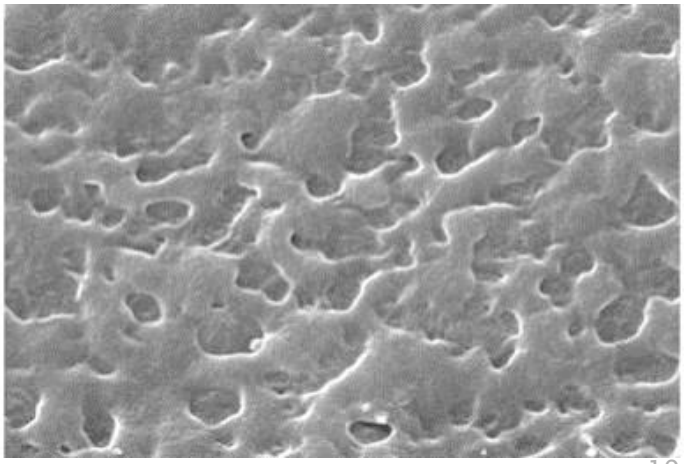
→ Air is made up of oxygen, nitrogen, and water vapor (water vapor is the smallest molecule)



Tyvek



GoreTex



HDPE

Air, Vapor, Water Barriers

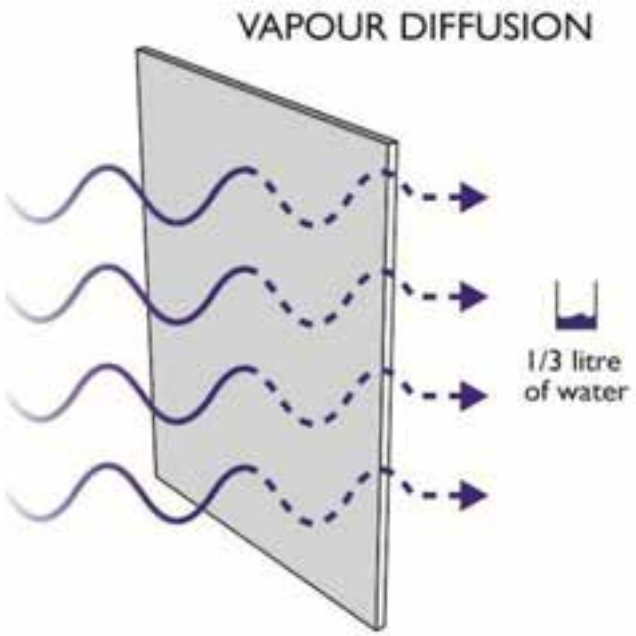
→ WRB / AB need to be continuous: required by code

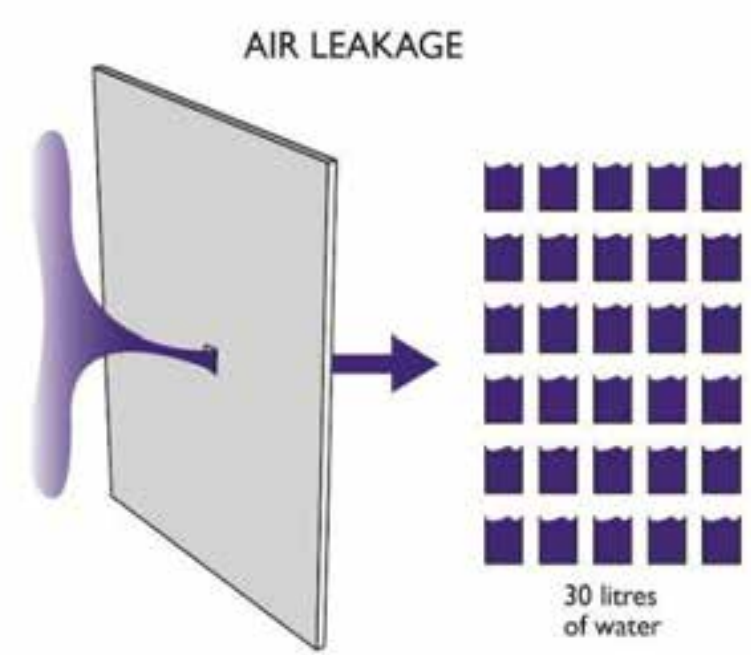
→ VB doesn't need to be continuous: sometimes required by code

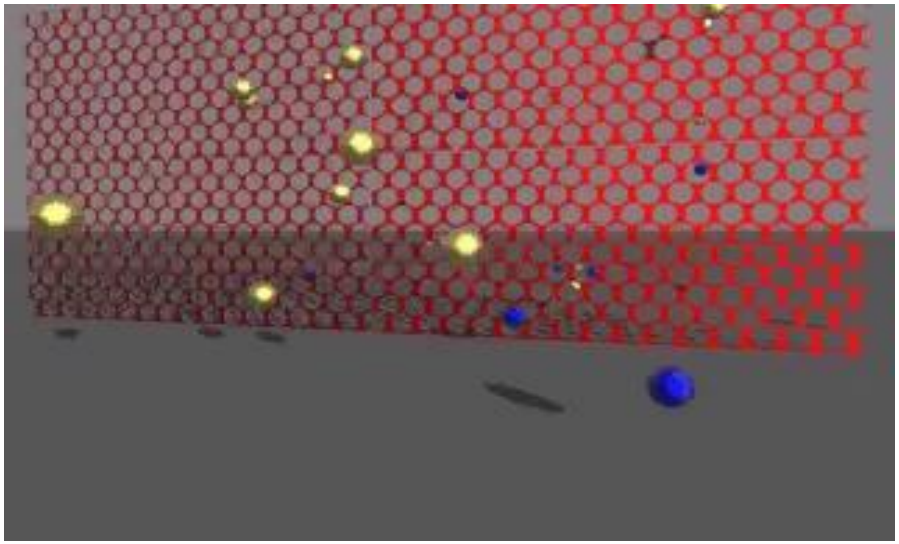
→ *Membranes can be:*

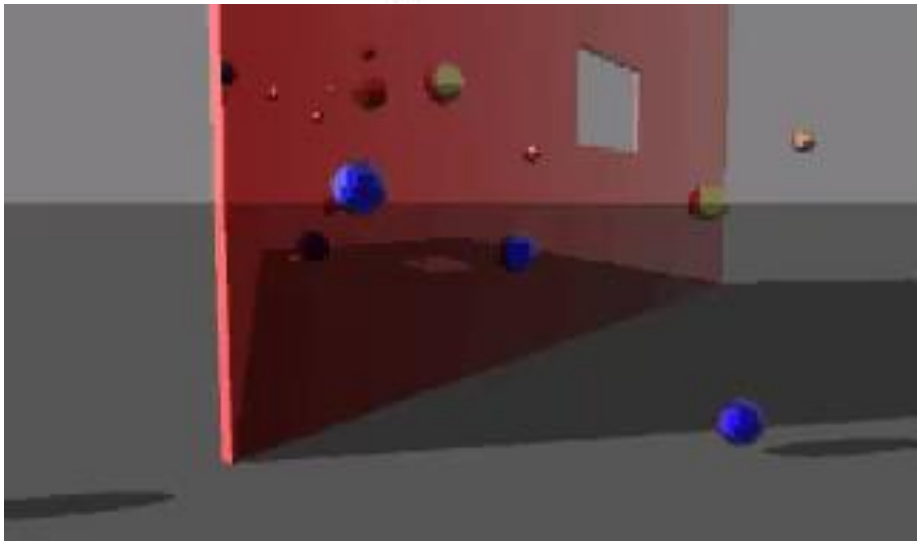
1. Water control
2. Air & water control
3. Air, water & vapor control

Air Leakage vs. Diffusion









Air Penetration Control – Why?

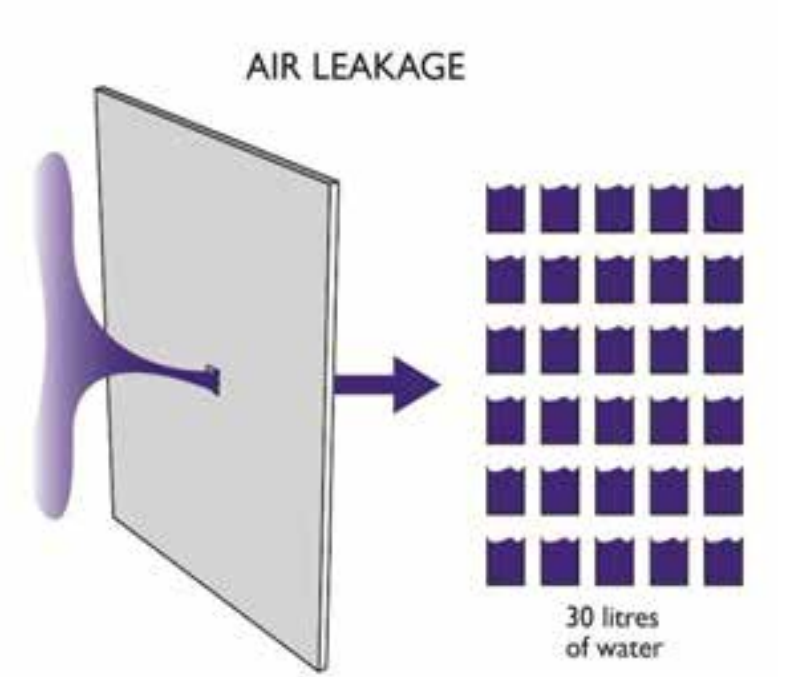
→ Code requirement

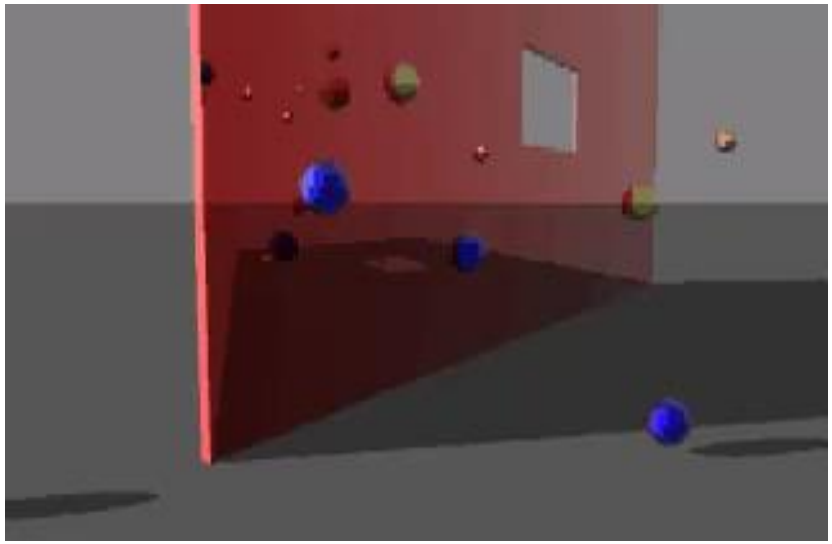
→ Moisture

→ Air holds moisture that can be transported and deposited within assemblies.

→ Energy

→ Unintentional airflow through the building enclosure can account for as much as 50% of the space heat loss/gain in buildings.





Types of Air Barrier Systems

Loose Sheet Applied Membrane – Taped Joints & Strapping

Sealed Gypsum Sheathing – Sealant Filler at Joints

Liquid Applied – Silicone sealants and silicone membrane at Joints

Sealed Plywood Sheathing – Sealant & Membrane at Joints

Sealed Sheathing – Membrane at Joints

Self-Adhered vapor permeable membrane

Plywood sheathing with taped joints (good tape)

Airtightness Does Not Happen By Accident

How to Tell the Membrane is Not the Air Barrier

Definitely Not An Air Barrier… But What Is?

Conductive Heat Loss Control

Conductive Heat Loss Control

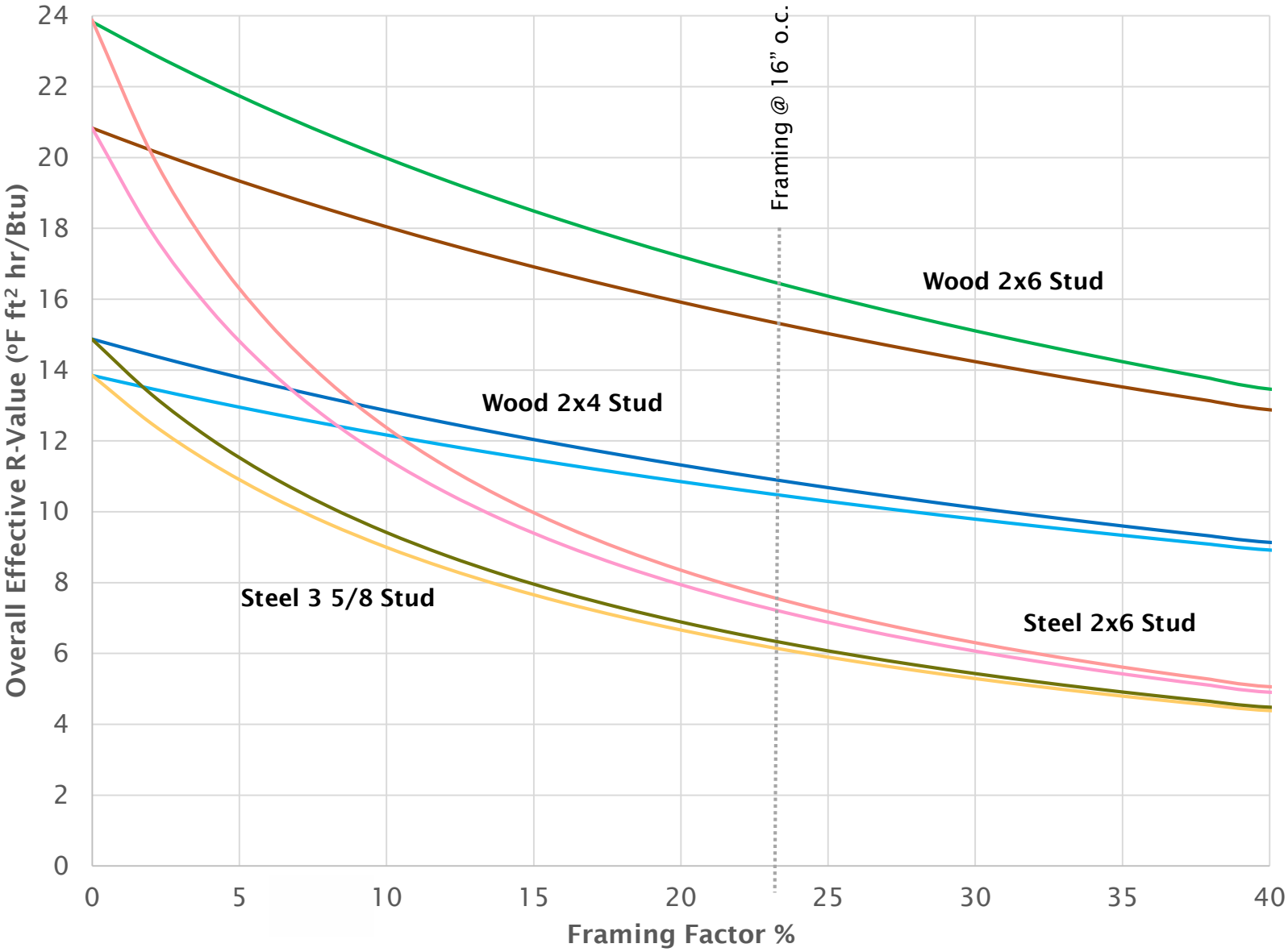
→ Insulation between studs is most common heat control strategy

→ Need to consider effective R-values

→ Wood ± R-1 per inch

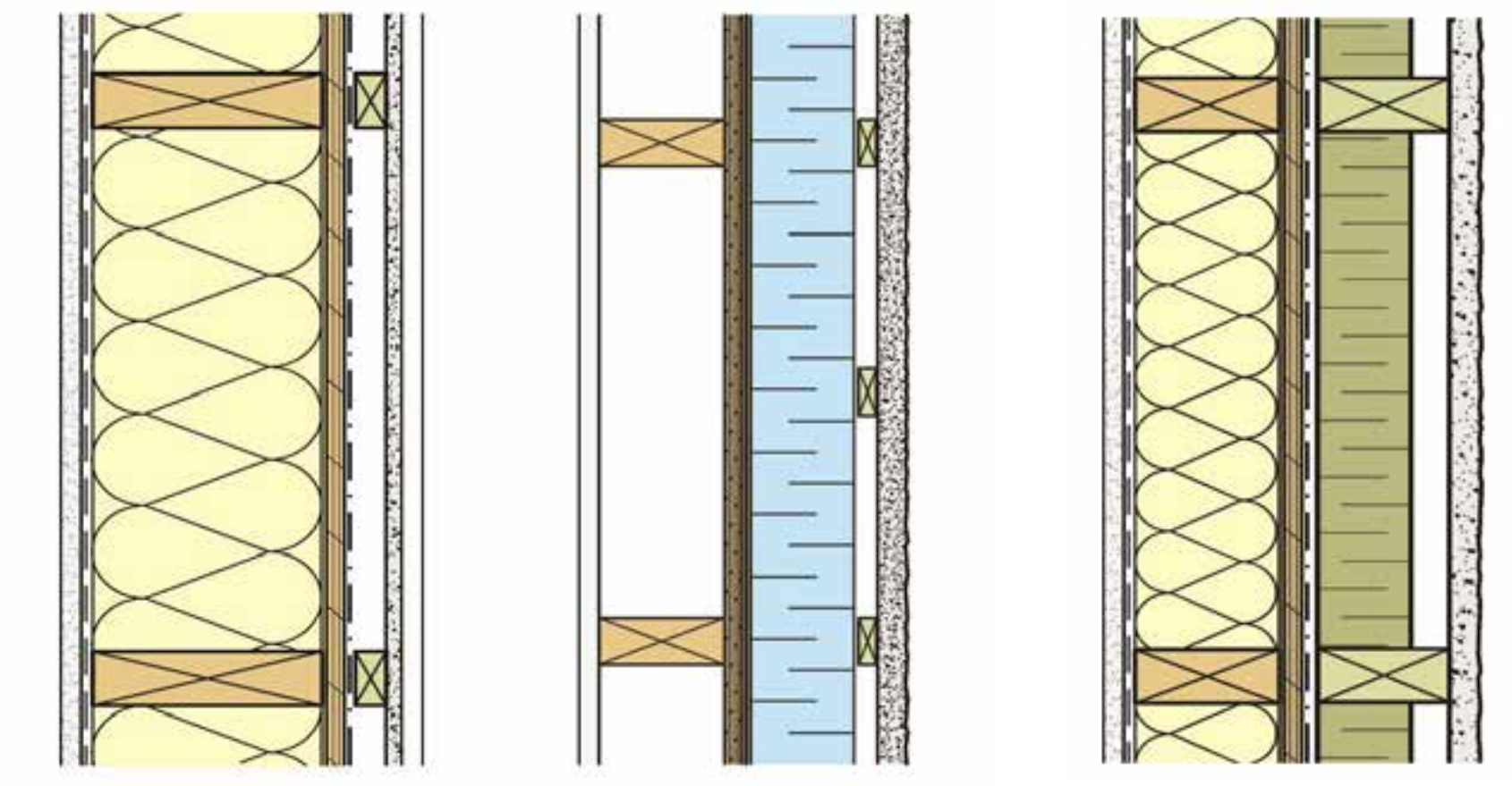
→ "Continuous insulation" may be required in some climate zones per IECC

Framing Effect on R-values



Insulation Placement

→ Consider effective thermal resistance, vapor diffusion profile, and relative durability



Exterior Insulation Selection (Vapor Control)

→ Rigid exterior foam insulations (XPS, EPS, Polyiso, closed cell SPF) are vapor impermeable

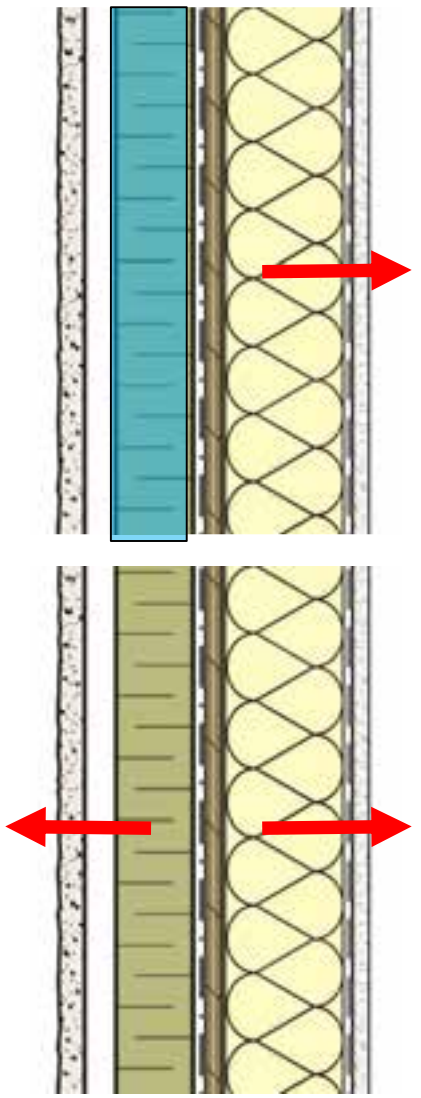
  → Rules of thumb: Vapor barrier on 'warm' side

→ Fibrous insulations (mineral fiber / glass fiber) are vapor permeable

  → Allows drying to the exterior

  → Often safer in cold and mixed climates

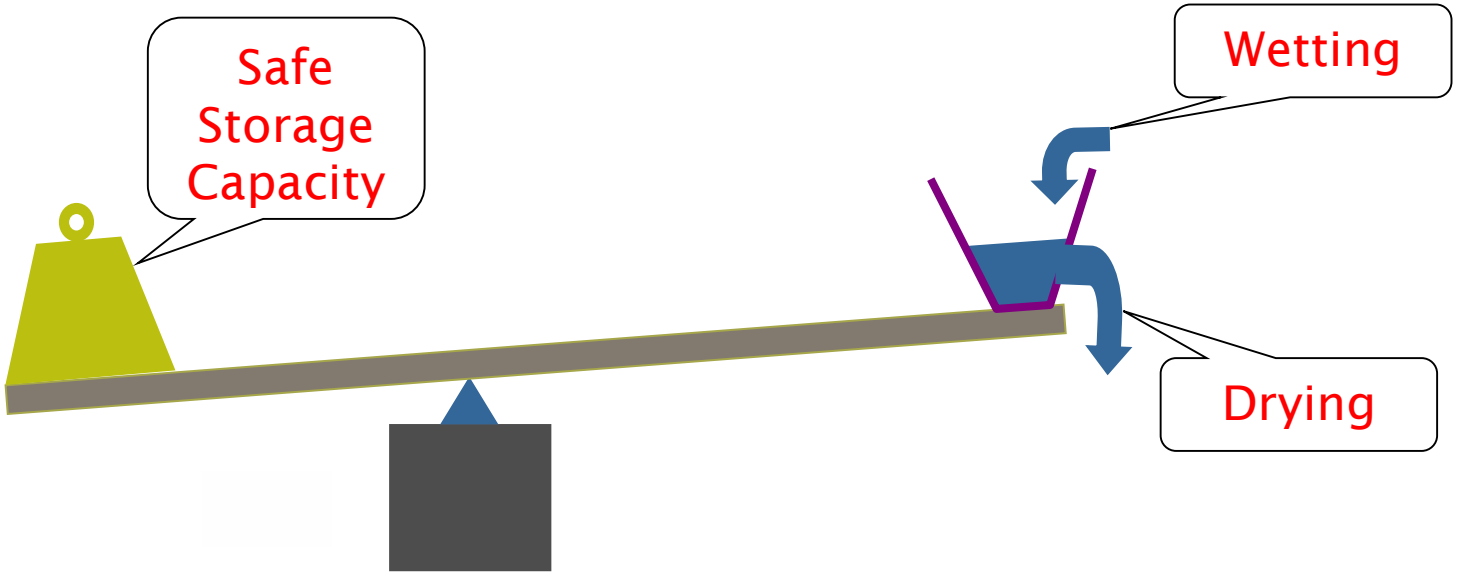
  → Could be coupled with another vapor control layer if desired



Building Science: Wetting and Drying

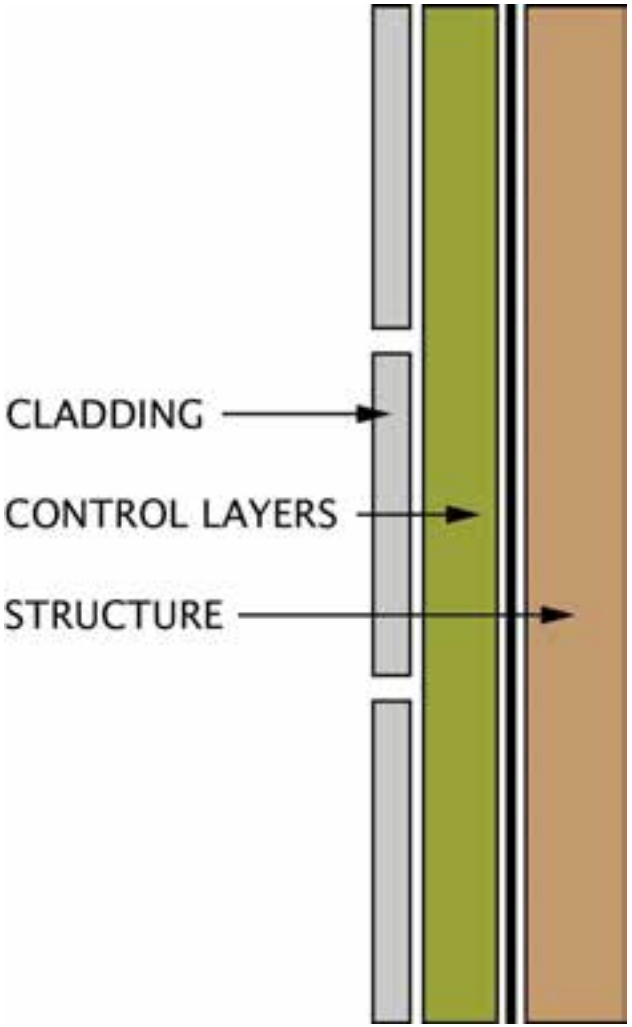
→ How can we keep the sheathing and other materials dry?

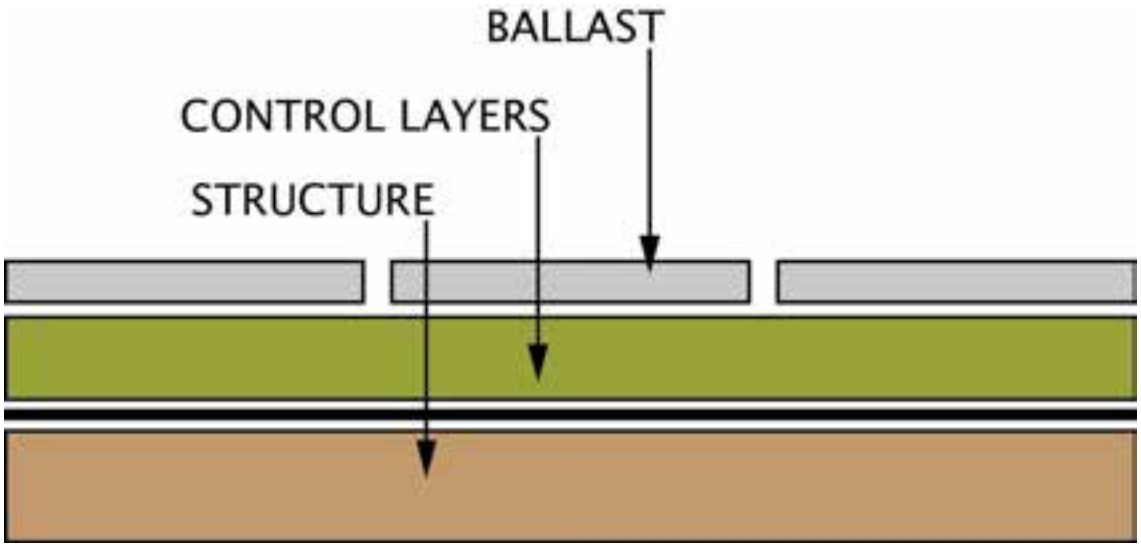
- → Don't let them get as wet
- → Create air space to promote drying
- → Design for vapor diffusion drying



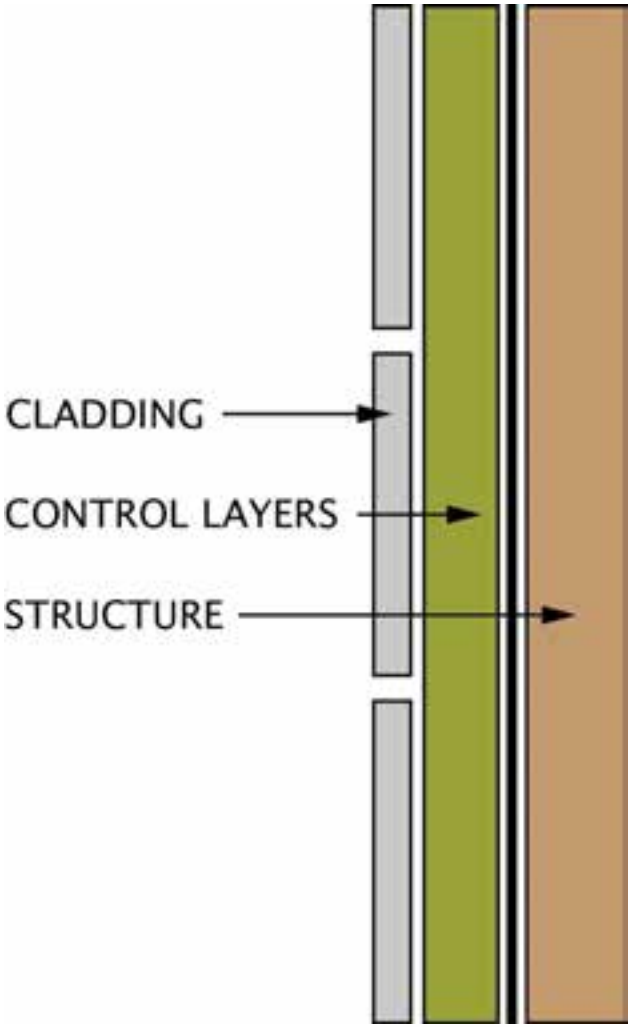
The 'Perfect' Assembly

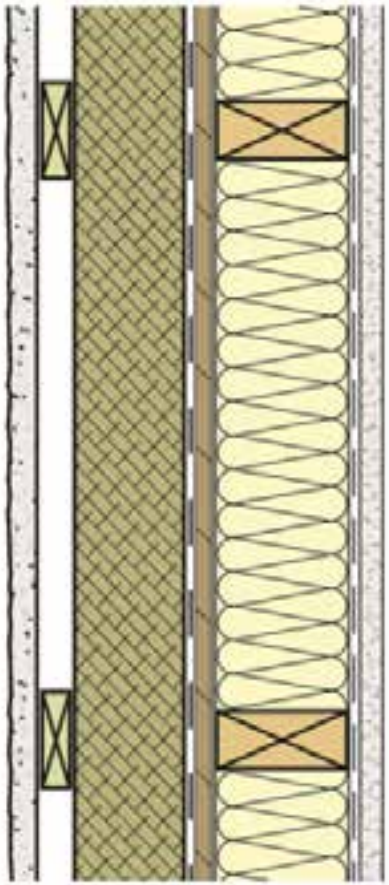
- → Rain penetration control: drained cladding over water barrier
- → Air leakage control: robust air barrier system
- → Heat control: continuous insulation layer
- → Locate all barriers **exterior** of structure
  - → Keep structure warm and dry
- → 50+ year old concept!





Wood-Frame Assemblies – 'Perfect' Wall



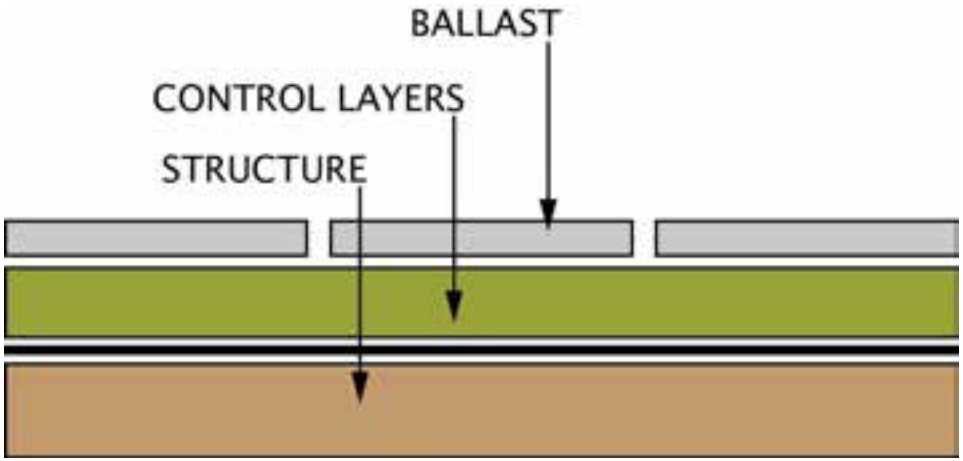


EXTERIOR

- Cladding
- Airspace (ventilated)
- 1x3 wood strapping, screwed through Insulation
- Rigid, mineral-fibre insulation (thickness to meet R-value requirement)
- Vapour-permeable sheathing membrane
- Sheathing (plywood or OSB)
- 2x4 or 2x6 wood framing with batt insulation
- Polyethylene film (cold climates only)
- Gypsum board and paint

INTERIOR

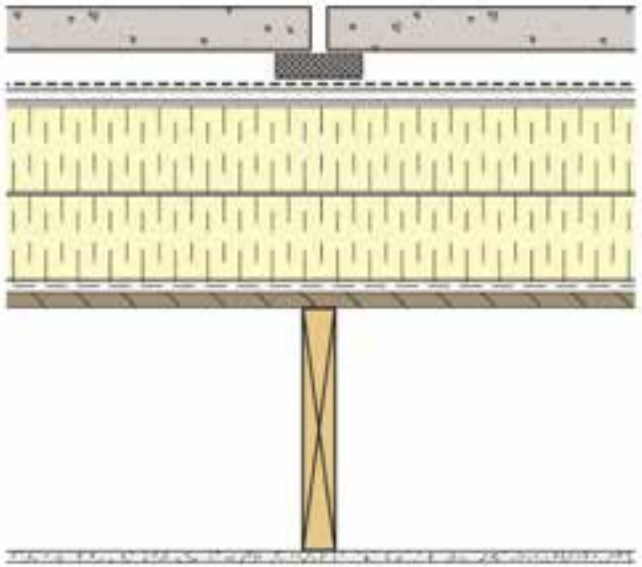
Wood-Frame Assemblies – 'Perfect' Roof



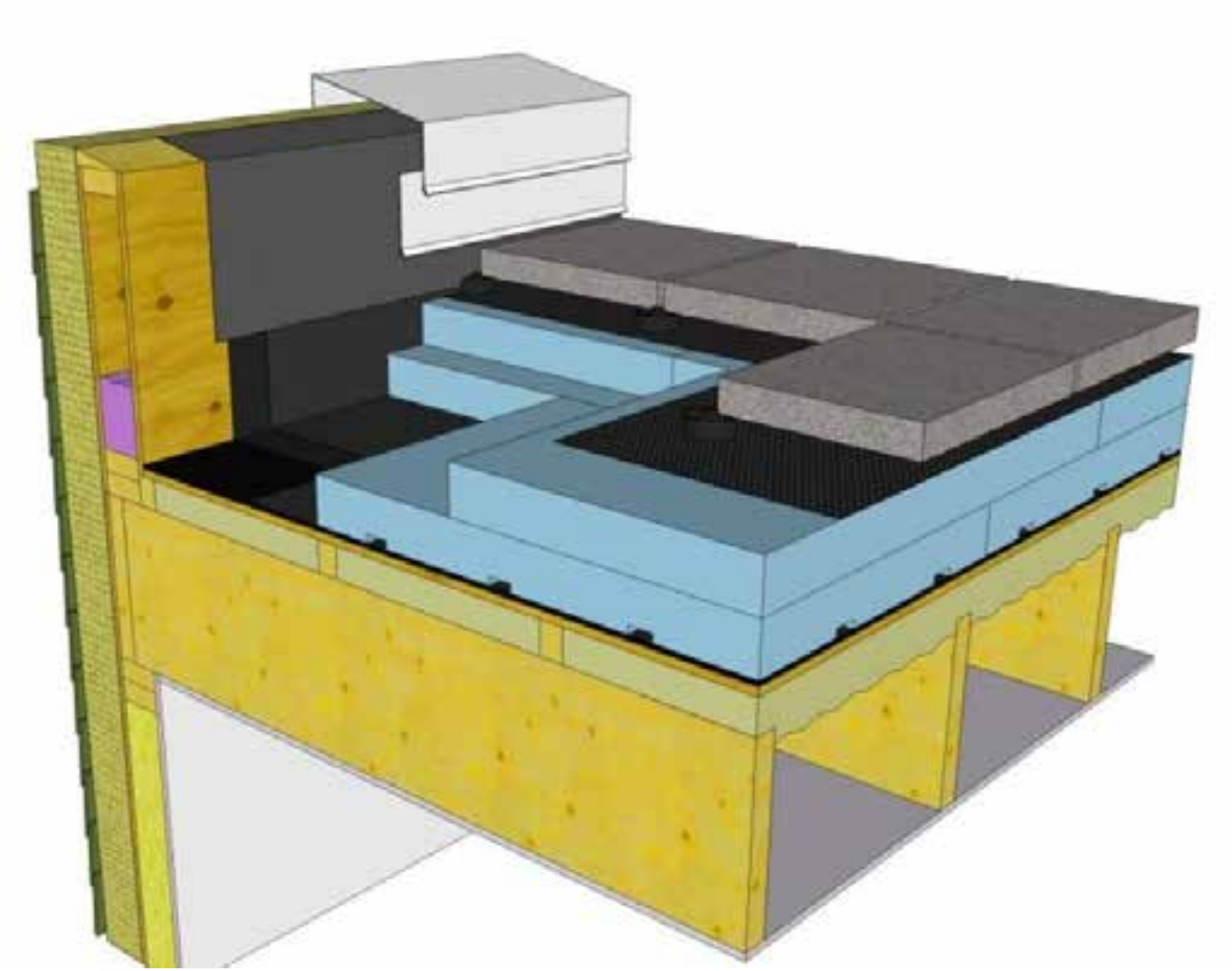
EXTERIOR

- Pavers and pedestal system (roof deck)
- Waterproof roof membrane system
- Protection board
- Rigid insulation layers
- SAM air/vapour barrier
- Roof sheathing
- Roof joists
- Interior gypsum board

INTERIOR



Wall-to-Roof Detail

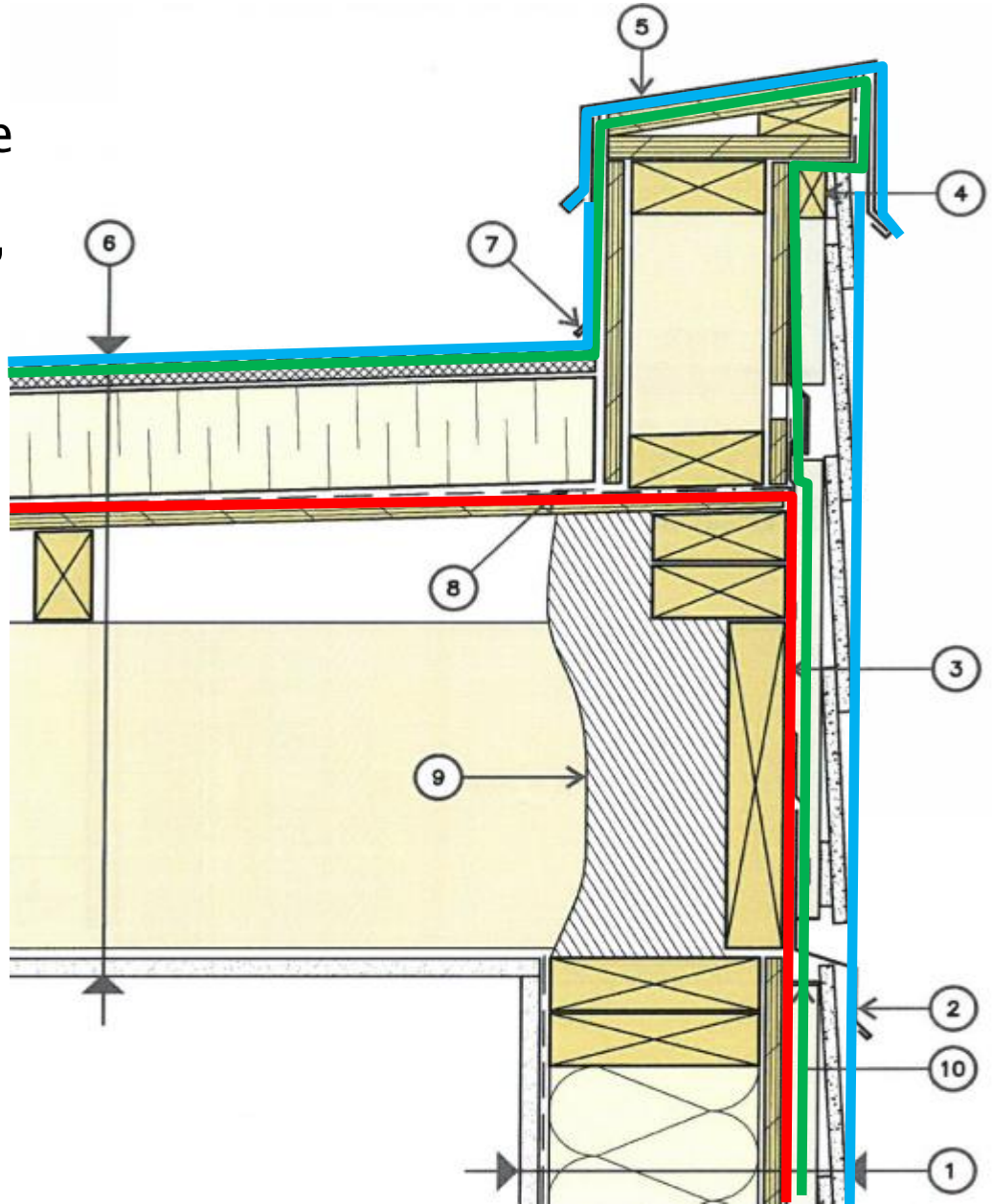


Details – Continuity of Control Layers

→ In practice, need to evaluate and design assemblies and details that are not ‘perfect’

→ Continuity of control layers within and between assemblies is critical

→ More on this later

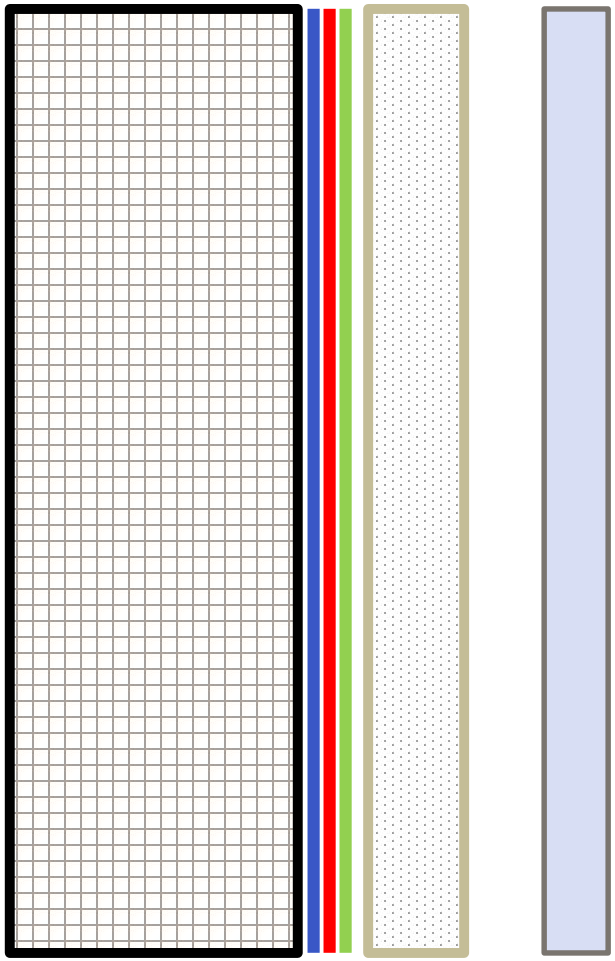


Wall Assembly in Florida

INTERIOR

AC & DRY

Temperature – 70F
Dew Point – 50F



EXTERIOR

HOT & HUMID

Temperature – 90F
Dew Point – 75F

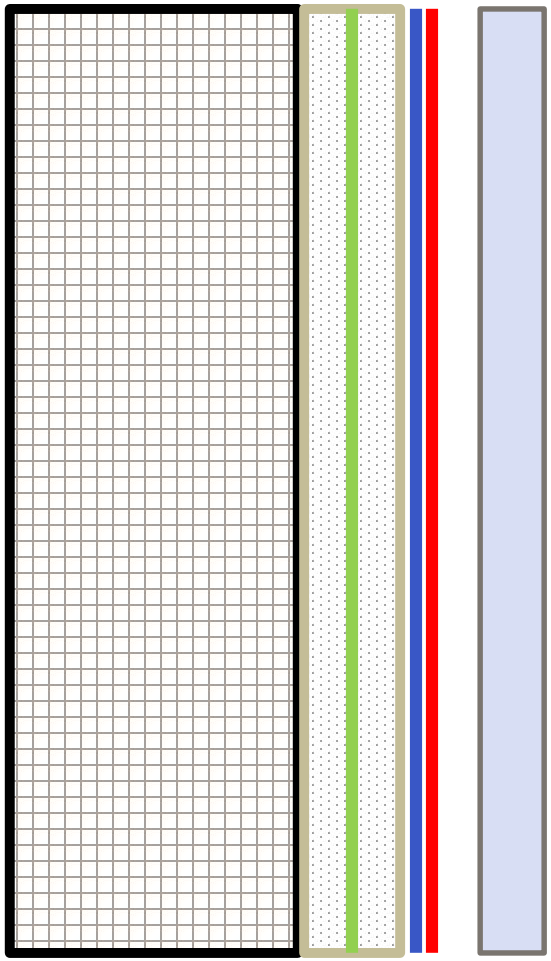

SOPREMA

Wall Assembly in Florida

INTERIOR

AC & DRY

Temperature – 70F
Dew Point – 50F



EXTERIOR

HOT & HUMID

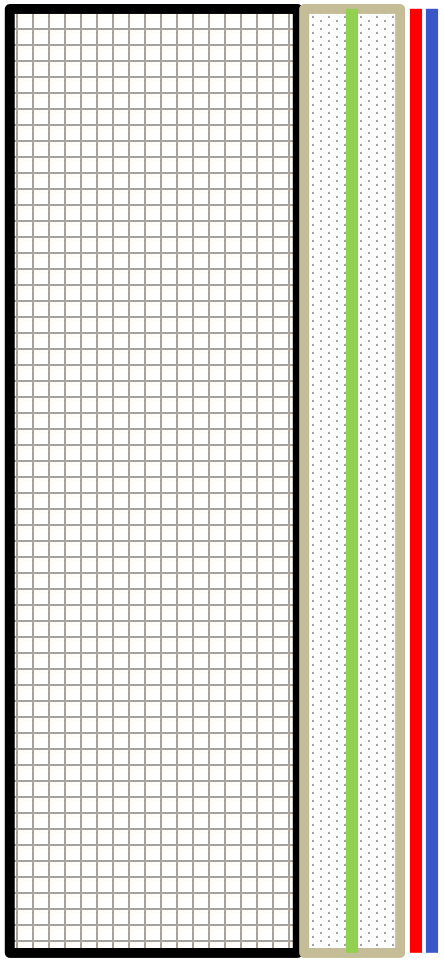
Temperature – 90F
Dew Point – 75F

Wall Assembly in Charleston

INTERIOR

AC & DRY

Temperature – 70F
Dew Point – 50F



EXTERIOR

HOT & HUMID

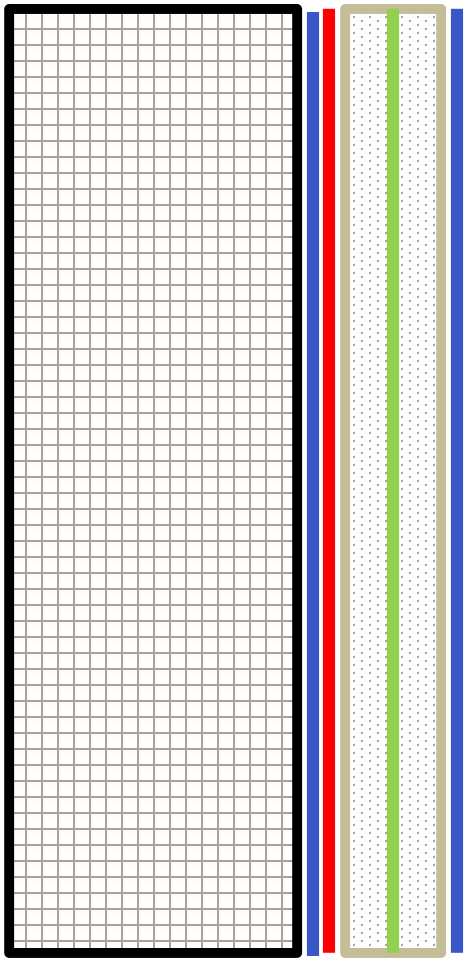
Temperature – 90F
Dew Point – 75F

Wall Assembly in Charleston

INTERIOR

AC & DRY

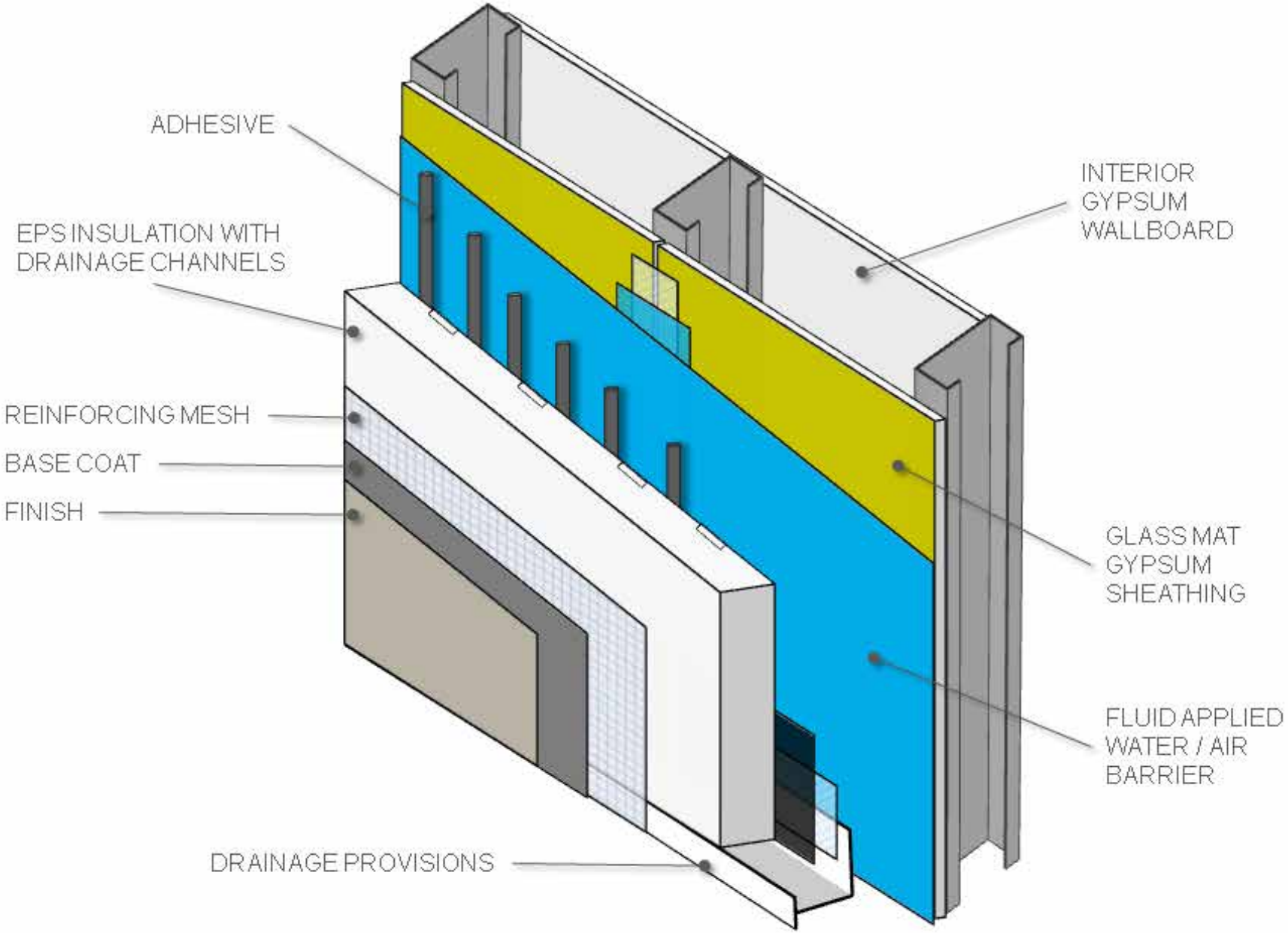
Temperature – 70F
Dew Point – 50F



EXTERIOR

HOT & HUMID

Temperature – 90F
Dew Point – 75F

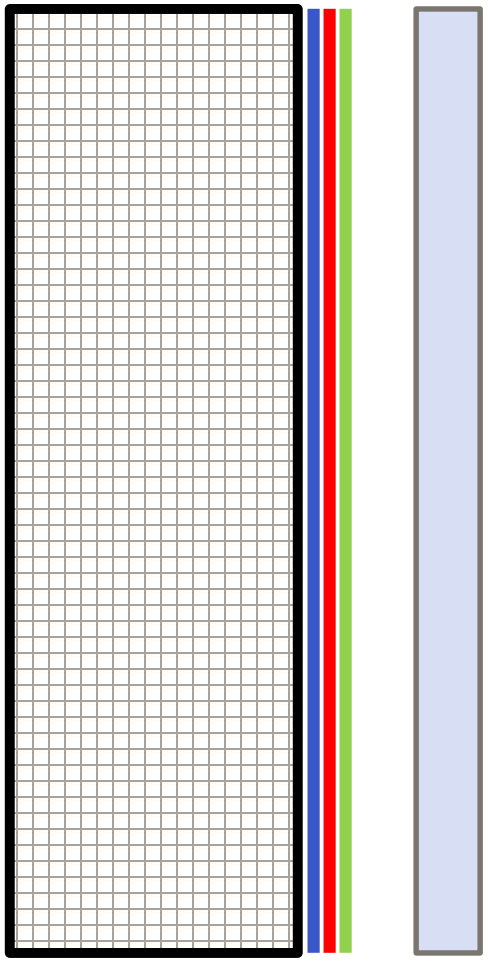

ADHESIVE
EPS INSULATION WITH
DRAINAGE CHANNELS
REINFORCING MESH
BASE COAT
FINISH
DRAINAGE PROVISIONS
INTERIOR
GYPSUM
WALLBOARD
GLASS MAT
GYPSUM
SHEATHING
FLUID APPLIED
WATER / AIR
BARRIER

Wall Assembly in Charleston

INTERIOR

AC & DRY

Temperature – 70F
Dew Point – 50F



EXTERIOR

HOT & HUMID

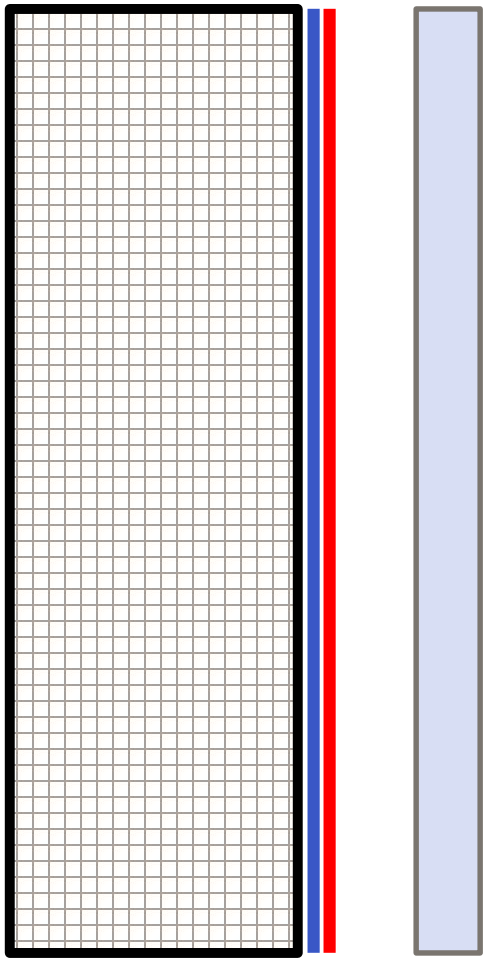
Temperature – 90F
Dew Point – 75F

Wall Assembly in Charleston

INTERIOR

AC & DRY

Temperature – 70F
Dew Point – 50F



EXTERIOR

HOT & HUMID

Temperature – 90F
Dew Point – 75F

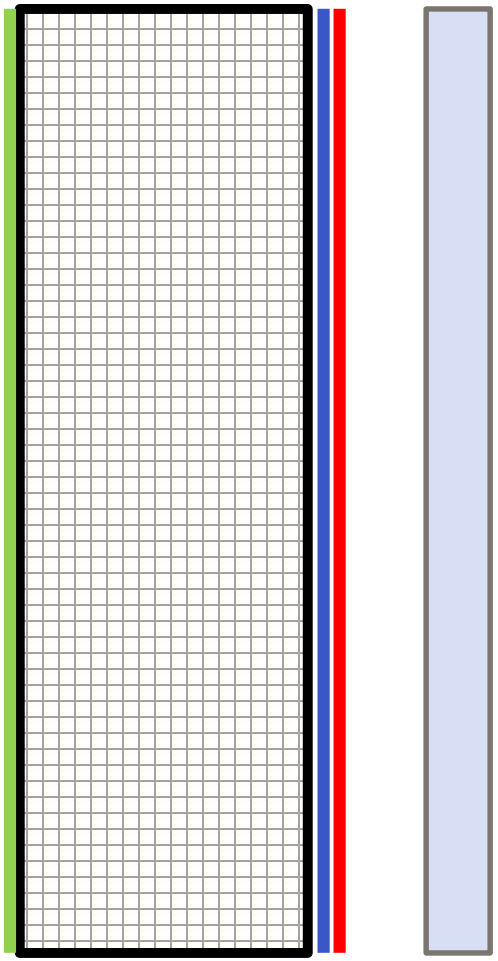

DELTA VENT SA

Wall Assembly in Charleston

INTERIOR

AC & DRY

Temperature – 70F
Dew Point – 50F



EXTERIOR

HOT & HUMID

Temperature – 90F
Dew Point – 75F

Case Study

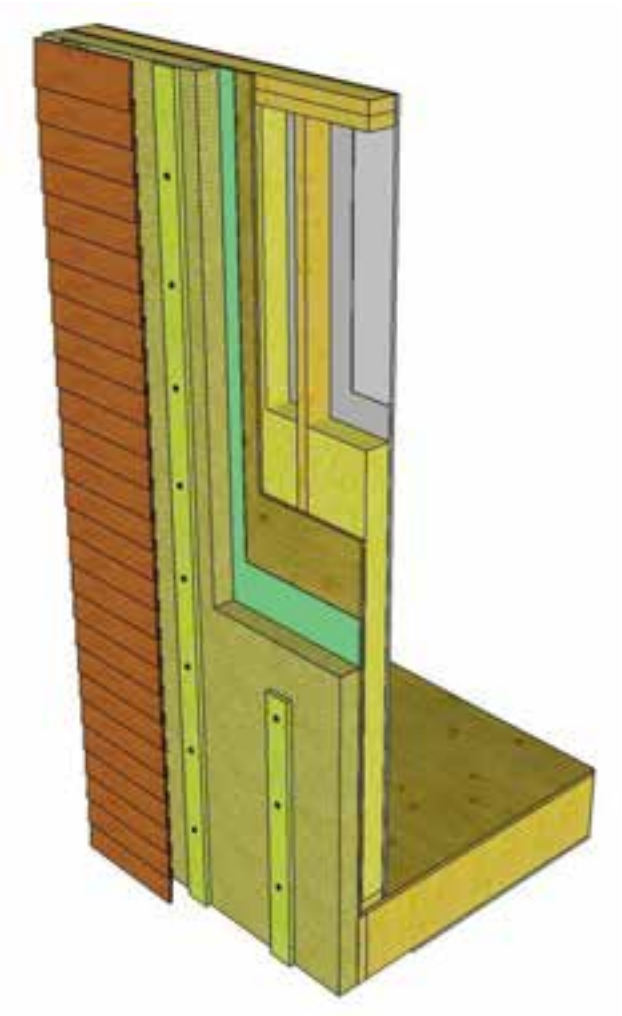
Deep Energy Retrofit

- → Moisture damage at walls and windows
- → Concealed barrier stucco cladding
- → Vented low-slope roof assembly
- → Energy efficient rehabilitation of wall, window, and roof assemblies

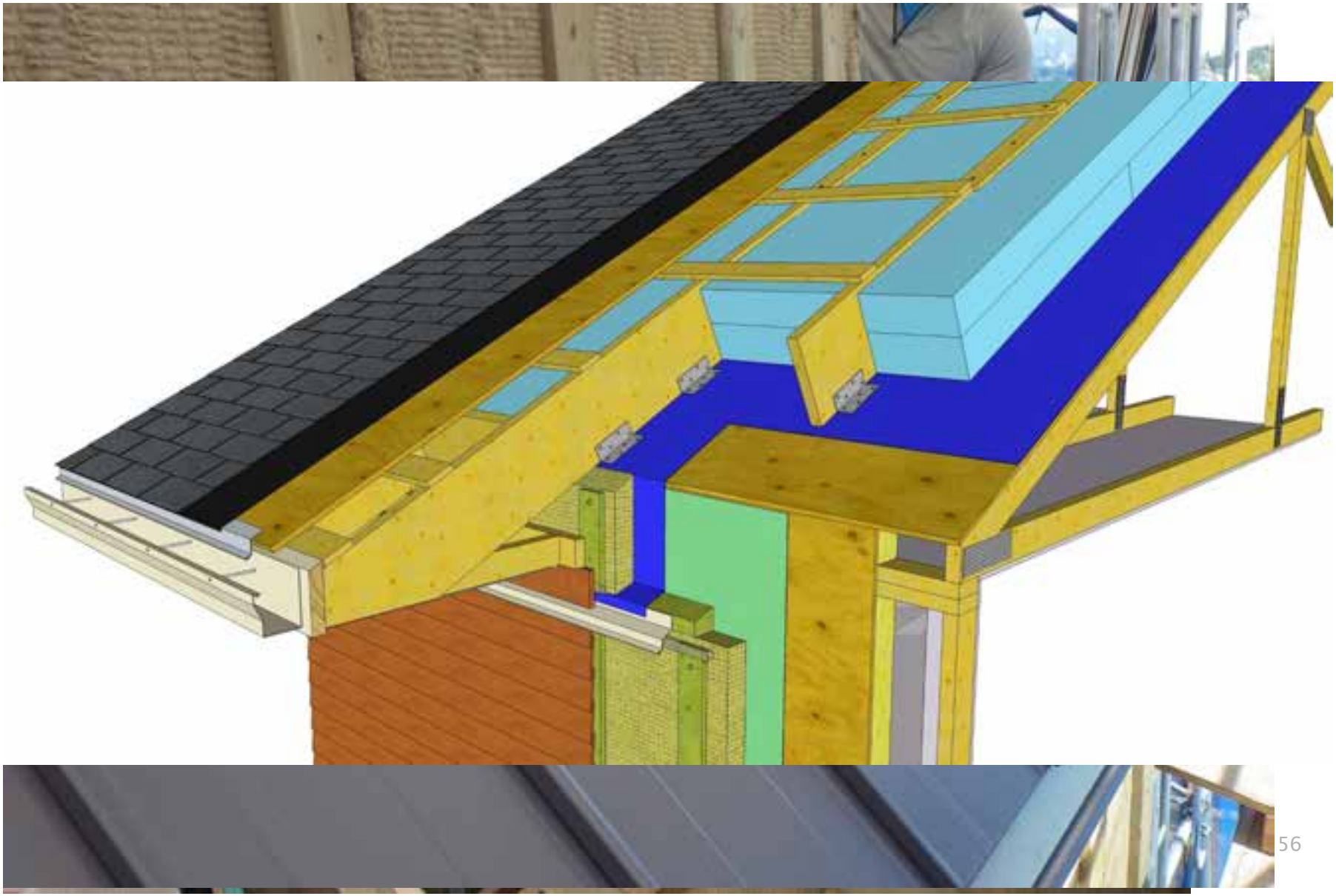
RDH BUILDING SCIENCE

5-Storey Wood-frame w/ Exterior Insulation

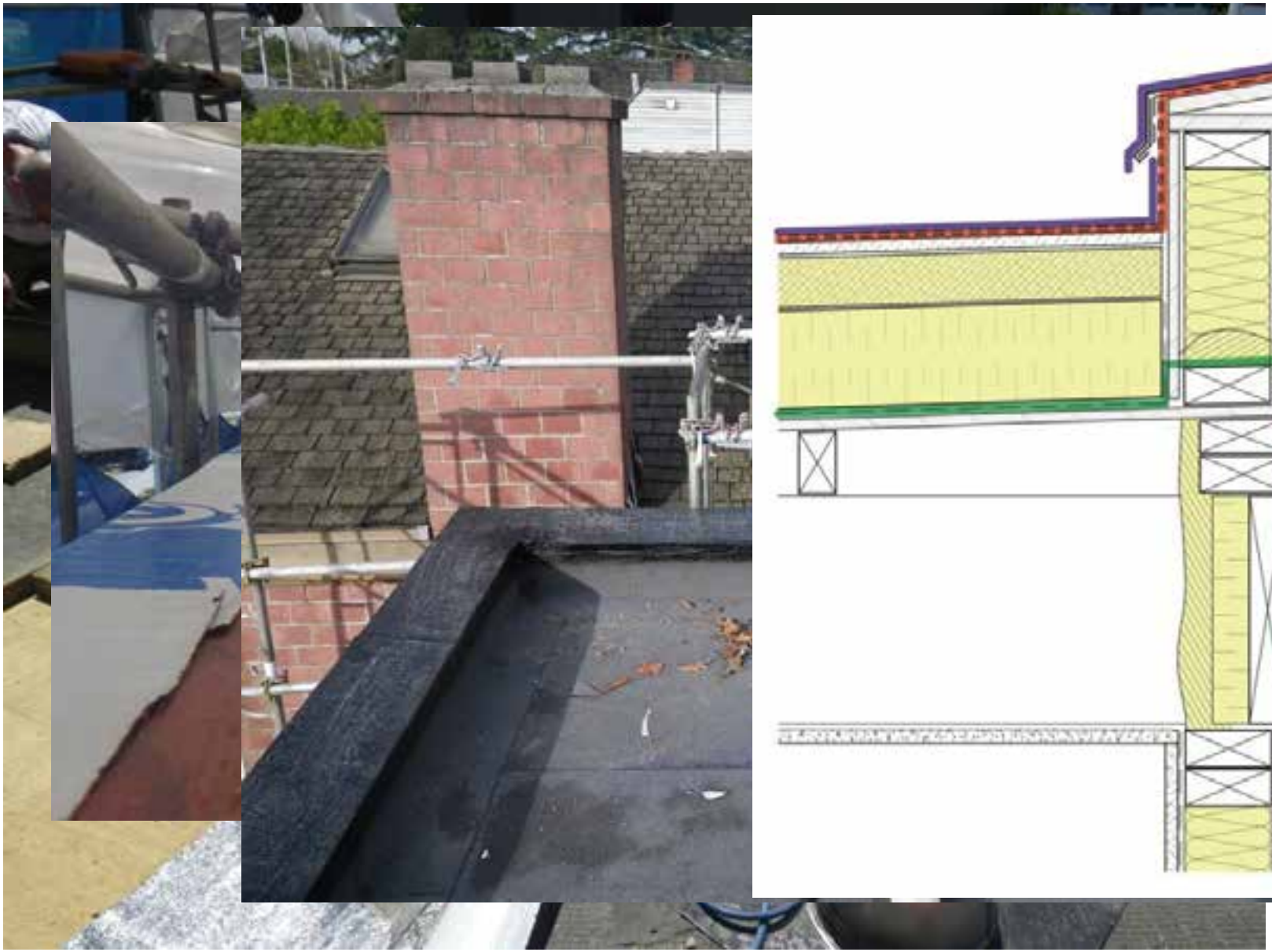
New Exterior Wall Assembly



New Sloped Roof / Overhang Assembly



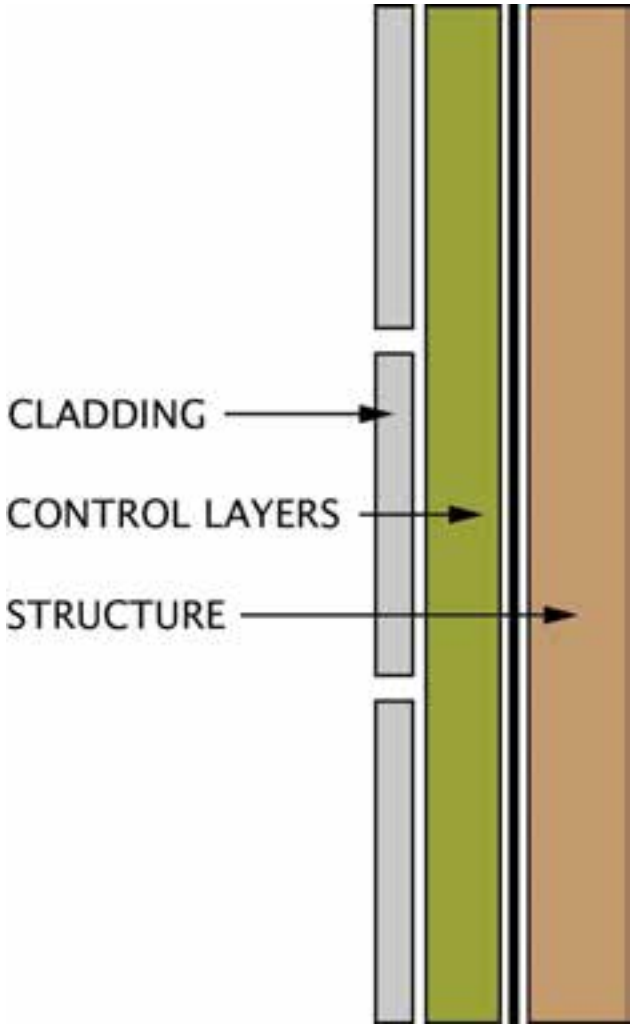
New Low-Slope Roof Assembly



Completed Building Enclosure

Summary

- → Control moisture, air, and heat
- → Best practices:
  - → Rainscreen cladding
  - → Keep structure warm and dry: control layers on exterior
- → 'Less than perfect' practices:
  - → Analyze and understand hygothermal behavior
- → Provide continuity of control layers within and between assemblies and details



This concludes The American Institute of Architects Continuing Education Systems Course

Colin Shane – cshane@rdh.com
www.rdh.com

RDH BUILDING SCIENCE