Moisture Management Strategies for Multifamily, Mixed-Use, & Light Commercial

Course Number: TamlynTW – EL133a

Thursday, June 21, 2018 – 2:15 pm

Learning Units 1.0 LU/HSW

A'18 AIA Conference on Architecture 2018
June 21-23, New York City

This program is registered with the AIA/CES for continuing professional education. As such, it does not include content that may be deemed or construed to constitute approval, sponsorship or endorsement by AIA of any method, product, service, enterprise or organization.

The statements expressed by speakers, panelists, and other participants reflect their own views and do not necessarily reflect the views or positions of The American Institute of Architects, or of AIA components, or those of their respective officers, directors, members, employees, or other organizations, groups or individuals associated with them.

Questions related to specific products and services may be addressed at the conclusion of this presentation.

Speakers List

- Ian Daniels

Course / Learning Objectives

- Learn how moisture impacts building durability.
- Understand the mechanics of moisture movement.
- Find out how to write better specifications and details to reduce moisture-related problems.
- Familiarize yourself with ASTM E2112 methods for flashing openings.

Design Goals for Buildings

- Durable and Long Lasting
- Energy Efficient
- Comfortable to Work and Live In
- Healthy and Safe to Work and Live In

Moisture = Problems

Moisture Problems are a Leading Cause of Construction Defects

Moisture Damage Contributes to 90% of all building and building material failures.
(ASHRAE)

The Construction Industry spends over $9 billion per year on construction defects that are due to water intrusion.
(ASTM)

Preventing Problems starts with Knowledge

Building Components Decay When

When the wetting rate exceeds the assembly's drying rate, decay and mold can occur.

When the moisture content of wood-based building materials increases and is sustained at over 22% fungal decay is inevitable. Studies have shown, however, that mold can grown on wood with a moisture content levels above 15%.

Building Science Fundamentals

- Heat moves from warmer areas to colder areas
- Moisture moves from wetter areas to dryer areas
- Pressure moves from high to low

All of the above impact the wetting and drying rates of building assemblies

How Wall Assemblies get Wet and Dry

Wetting

Liquid – leaks in building's cladding system (inherent with all types but more periodic in frequency)

Vapor – moisture carried via air and diffusion (constant in all environments)

Drying

Evaporation or diffusion – a slow process

Moisture Movement in Buildings

Water vapor moves via

- Air currents, infiltration and exfiltration
- Diffusion

Liquid water moves via

- Gravity
- Wind Driven Rain
- Capillary Action
- Pressure Differentials

Causes of Moisture Related Building Failures

- Architectural design that traps or directs water back into the building assemblies and does not allow sufficient drainage.
- Failure to detail a well-thought-out moisture management plan and specifying the wrong materials for the application
- Poor workmanship and substandard construction practices.
- Moisture generation from occupants and lack of maintenance

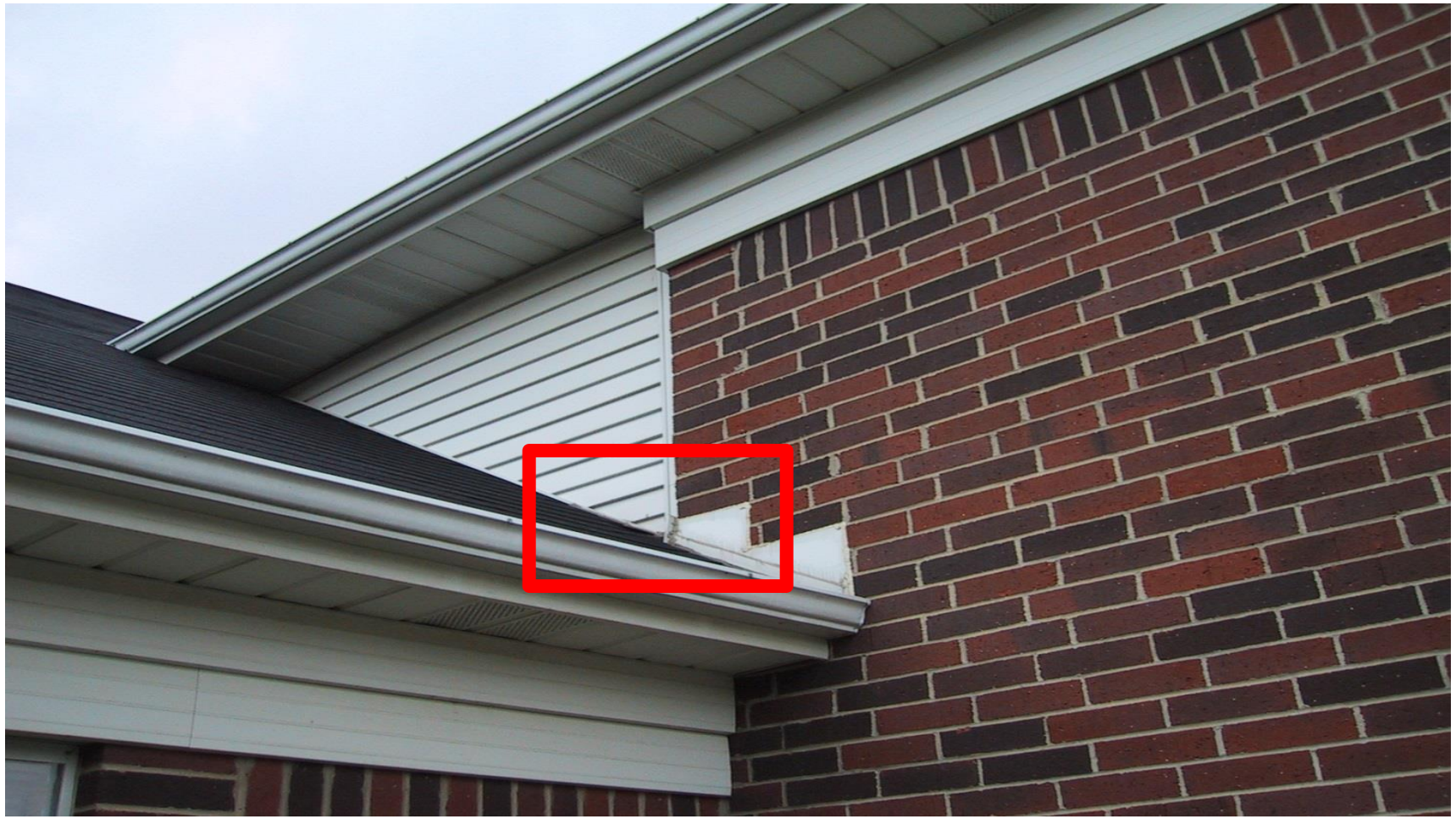
Design for Proper Site Drainage

Avoid Horizontal Valleys

Avoid Horizontal Valleys

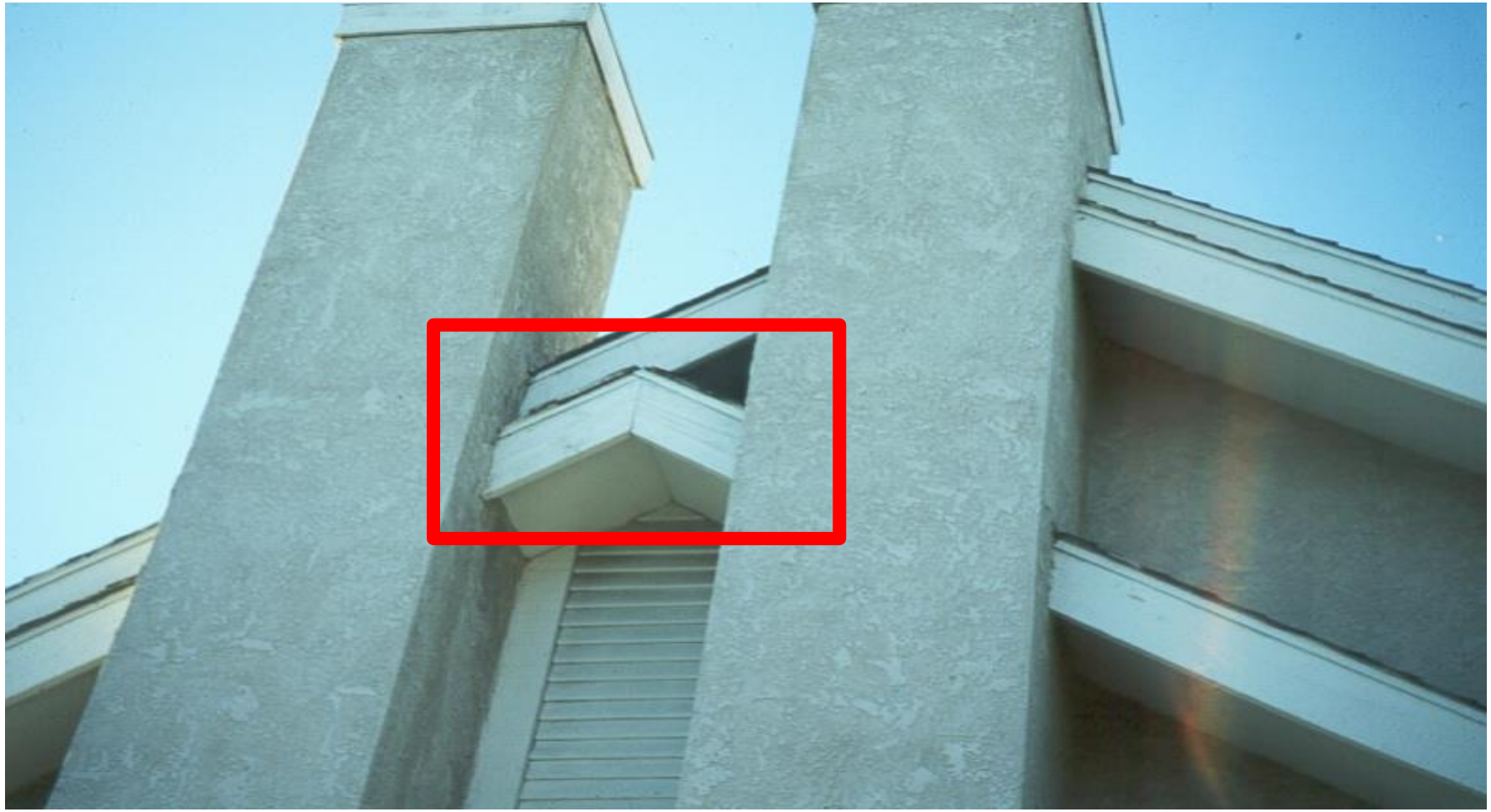
Avoid Horizontal Valleys

Avoid Water Catching Designs



Avoid Water Catching Designs

Avoid Water Catching Designs



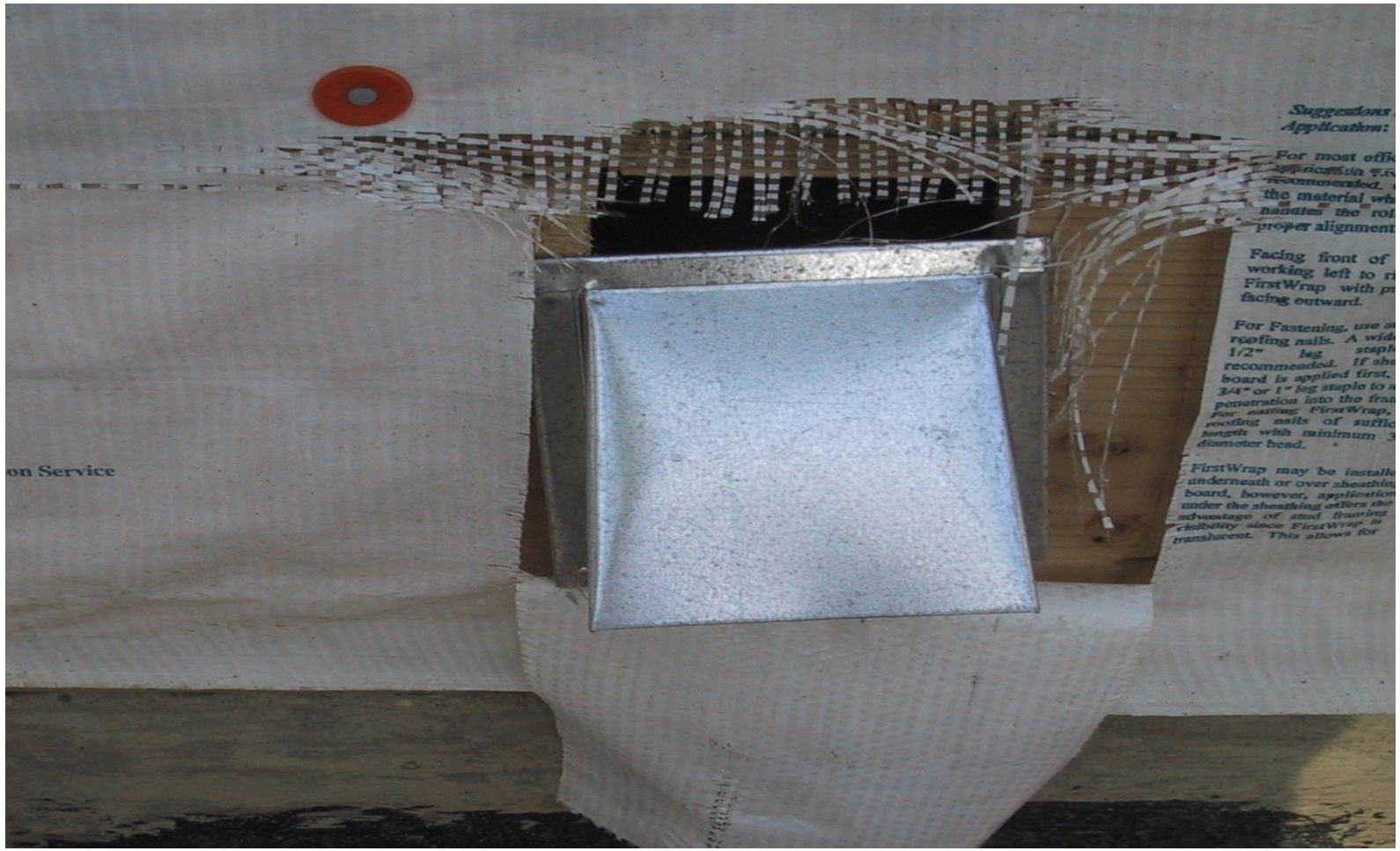
Design Proper Flashing for Roof/Wall Interface

Avoid Recessed Openings

Seal All Wall Penetrations BEFORE Cladding

Seal All Wall Penetrations BEFORE Cladding

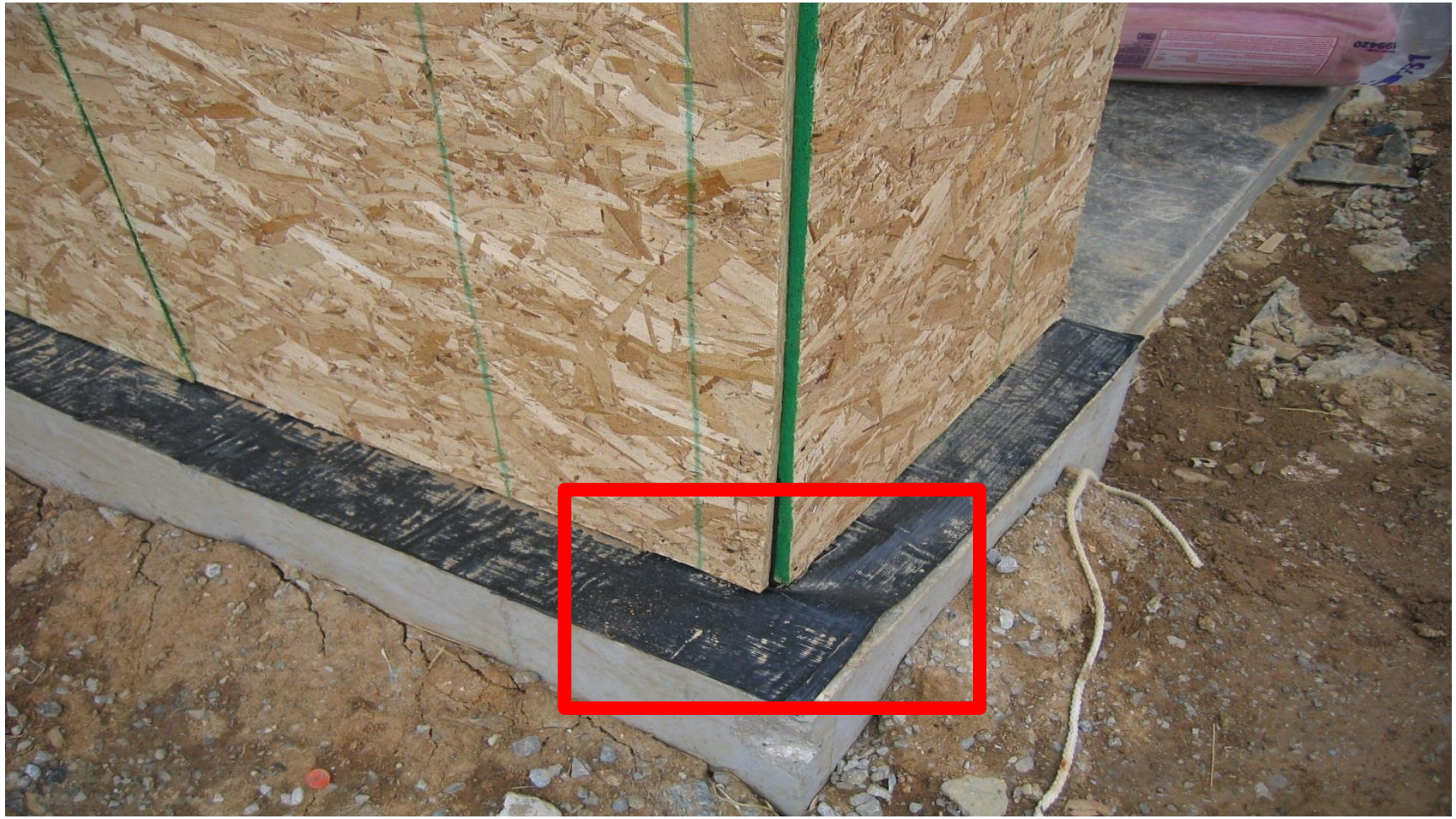
Seal All Wall Penetrations BEFORE Cladding



Seal All Wall Penetrations BEFORE Cladding

Design Details for Proper Shingle Fashion

Design Details for Proper Shingle Fashion



Building Codes and Standards Require Water Management Performance: IRC 2009, 2012

R703.1.1 **Water Resistance**

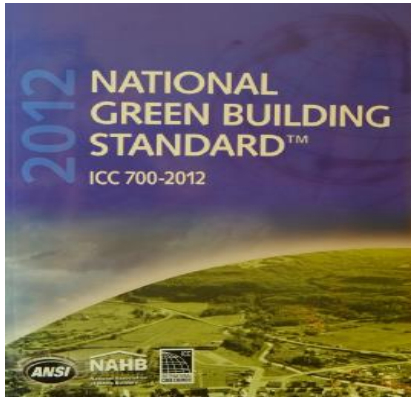
The exterior wall envelope shall be designed and constructed in a manner that prevents the accumulation of water within the wall assembly by providing a water-resistant barrier (WRB) behind the exterior veneer as required by Section R703.2 and a means of drainage to the exterior water that enters the assembly. Protection against condensation in the exterior wall assembly shall be provided in accordance with Section R601.3 (2009), Section R702.7 (2012) of this code.

Energy Star and Green Building Programs Require Water Management

2012 National Green Building Standard (NGBS 602.1.9) – awards points for drainable wraps

Energy Star Version 3 – requires a water management checklist for certification

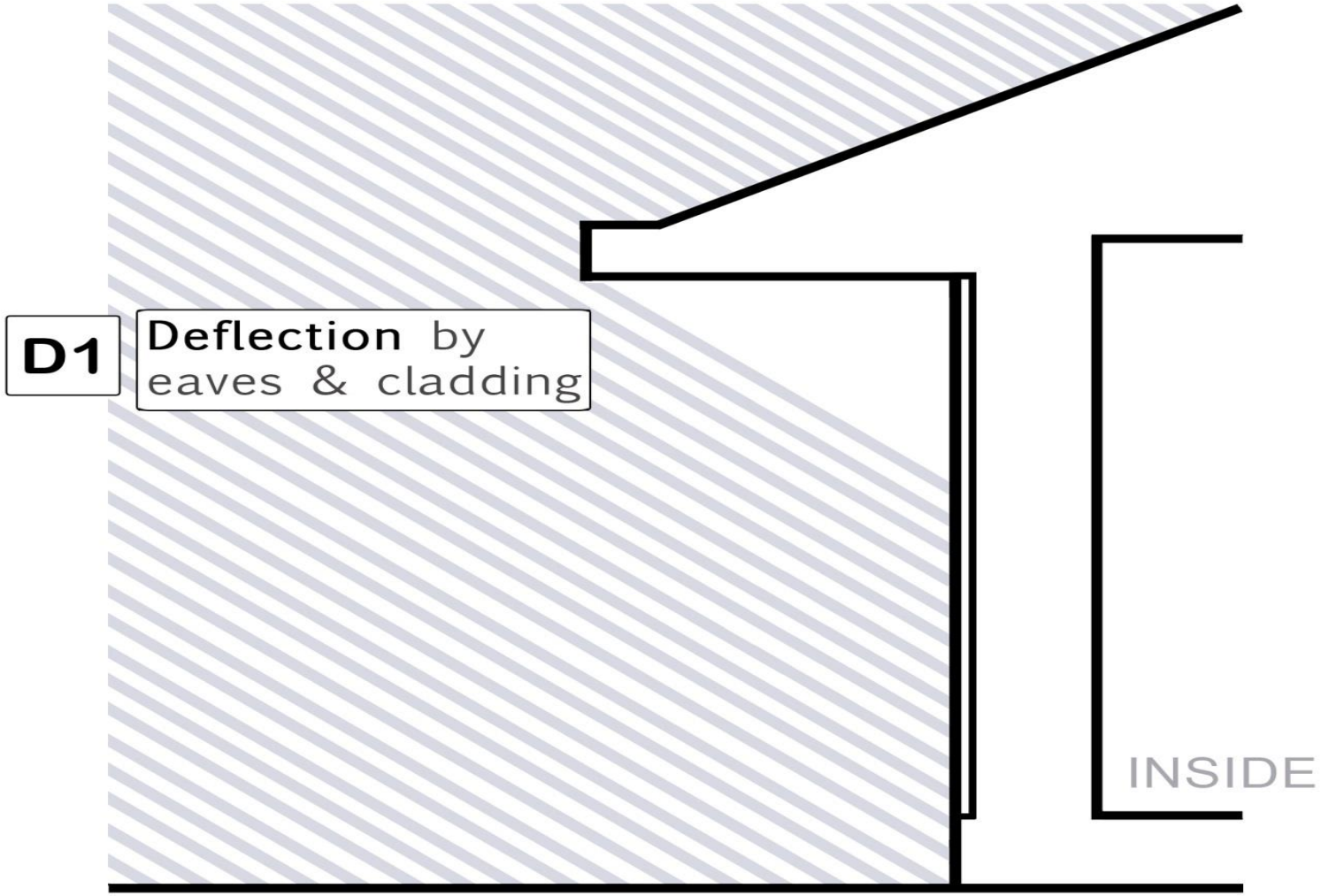
EPA airPlus Construction Specifications (Sec 1.5) – call for a continuous drainage plane



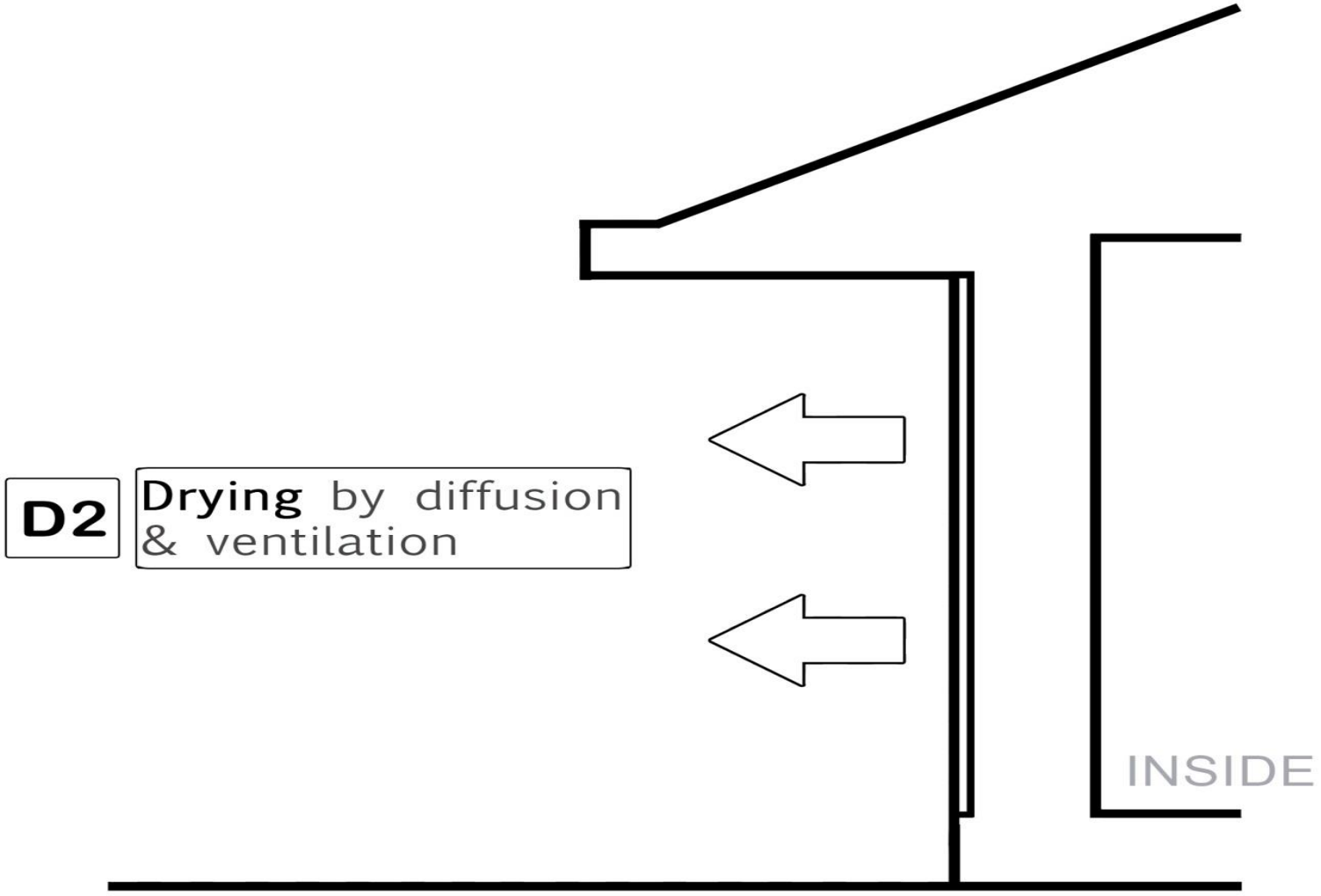
Moisture Management the 4 D’s

- Deflection
- Drying
- Drainage
- Durable Materials

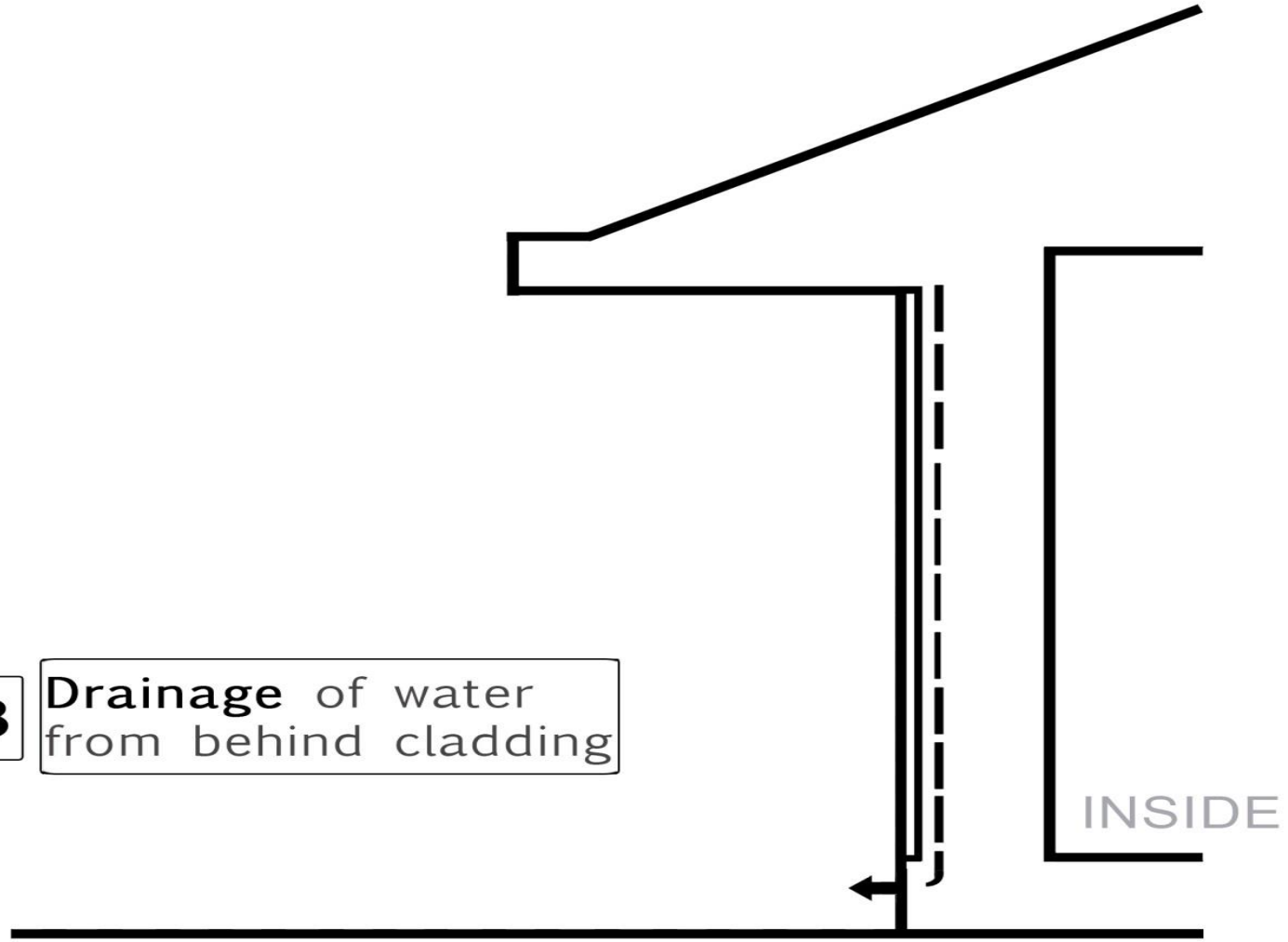
Moisture Management the 4 D’s



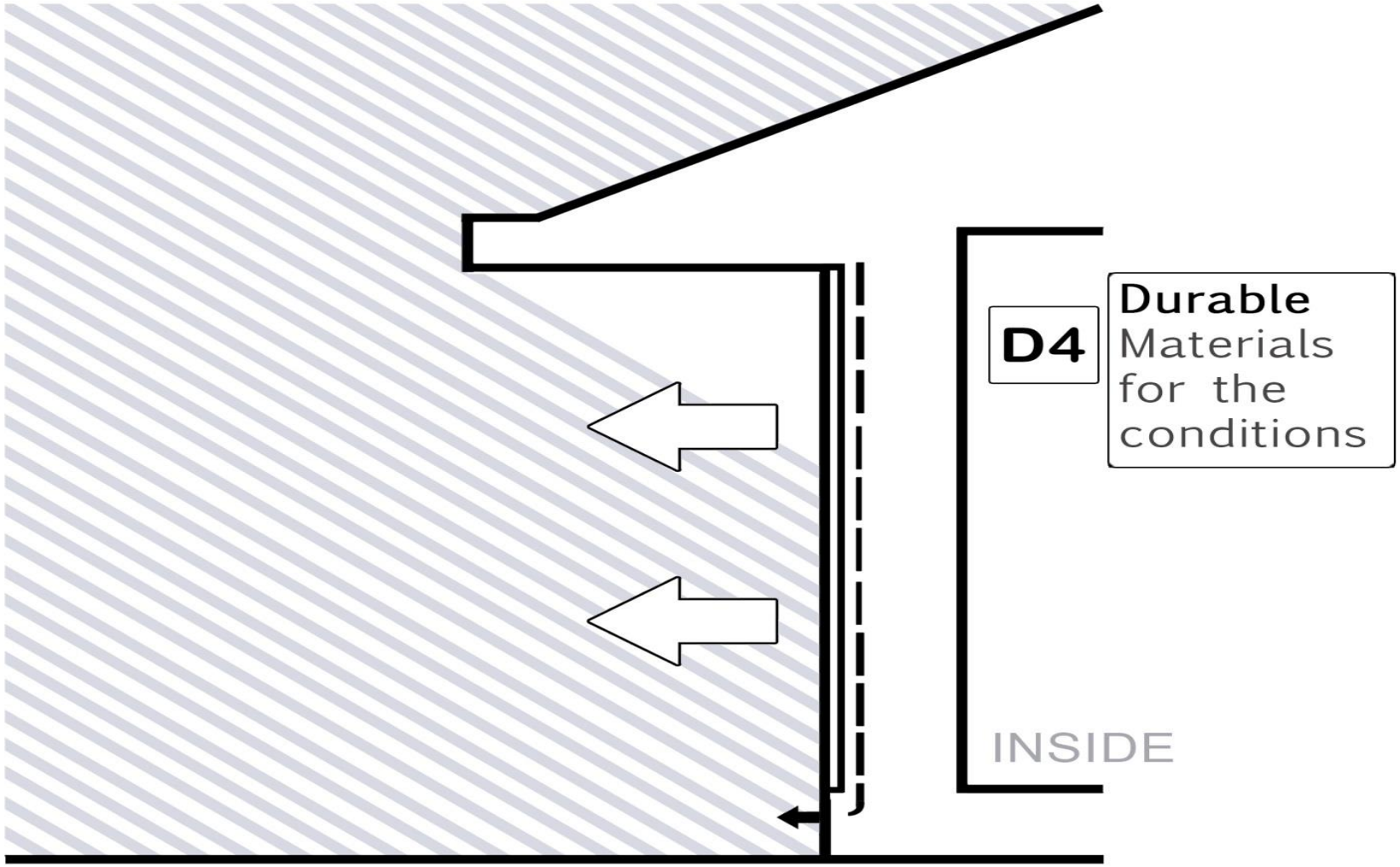
Moisture Management the 4 D’s



Moisture Management the 4 D's



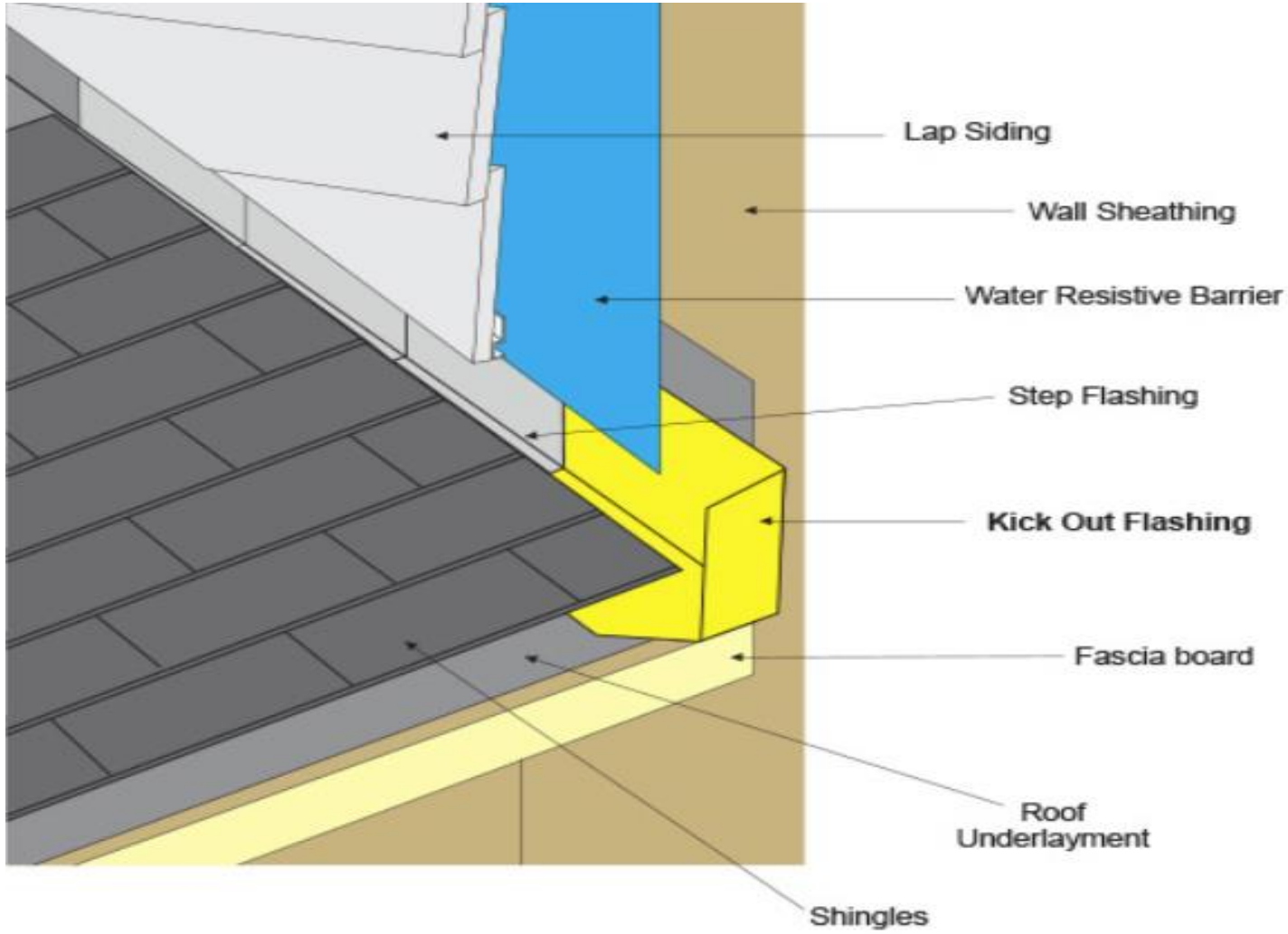
Moisture Management the 4 D's



Designing a Moisture Management System

- Step and Kick-Out flashings at roof to wall intersections
- Weather resistive barriers (WRB's) such as **Drainable Housewraps** or Rainscreens when applicable
- All penetrations sealed
- Self-adhered flashing systems and compatible sealants for windows, doors and all penetrations
- Thru-wall flashing at cladding transitions, openings and at the wall base in masonry, stucco and rainscreen claddings (weep system at base)
- A continuous exterior air barrier and interior air seal

Best Practice – Use Seamless Kick-out Flashing



Approaches to Wall Systems for Moisture Management

- Barrier Walls
- Drainable Walls
- Rainscreen Walls

Barrier Walls

Considered Least Effective

Relies on face sealing of everything – biggest weakness being joints

No path for drainage if there is a leak in the cladding (inevitable)

Is a Taped Sheathing a Reliable WRB or Air Barrier?

Can a tape stick for 50+ years?

Research Supporting Gaps – Drainable and Rainscreen Walls

Drainage

- Measured drainage rate of 1mm gap is greater than extreme driving rain intensity for worst climate in Canada. (Building Science Corporation)
- 1mm + gap can provide **96% drainage efficiency** in testing under ASTM E2273

Ventilated Drying for Cladding

- ¼” space can provide 4.2 air changes per hour on average size home with 1 Pascal of pressure. (Bodycote)
- Rainscreen walls dried 3x faster than walls without an airspace. (Building Research Association of New Zealand)

Reducing Moisture Movement with a Gap

"Most walls have *thousands* of holes in them. How come they don't leak? **No hydrostatic pressure, no problem.** All leaks are caused by holes, but not all holes cause leaks. Just because you have a hole does not mean you have 'a problem'. What are the odds that you are going to have holes? Pretty high. But if you drain the water away? No problem. **You need to install the siding over a small gap to control the hydrostatic pressure.**"

Dr. Joseph Lstiburek

Drainable Walls

Use a weather resistive barrier (WRB) to protect the wall assembly from water intrusion

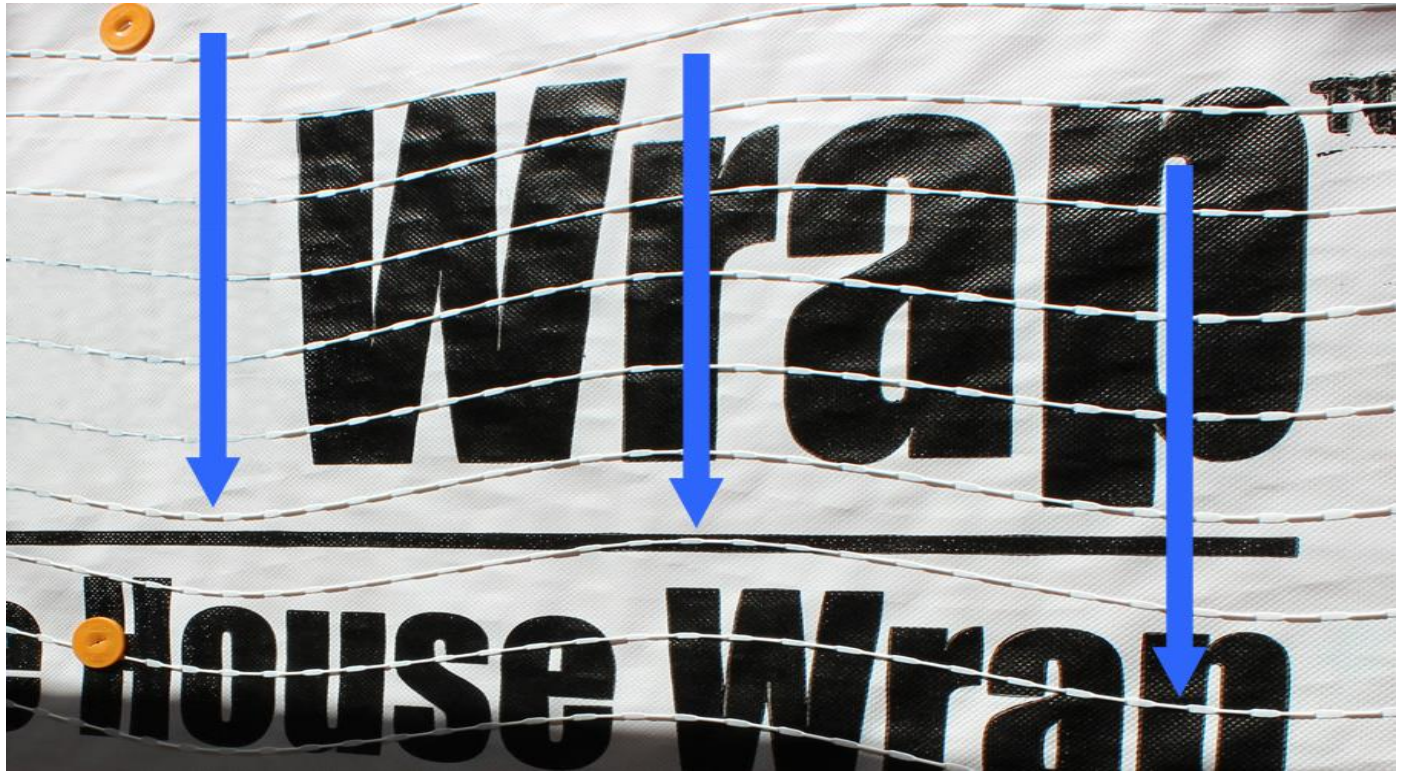
Best Practice is to use a **Drainable Housewrap**

Drainable Walls

Great ROI with added protection for relatively minor cost increase

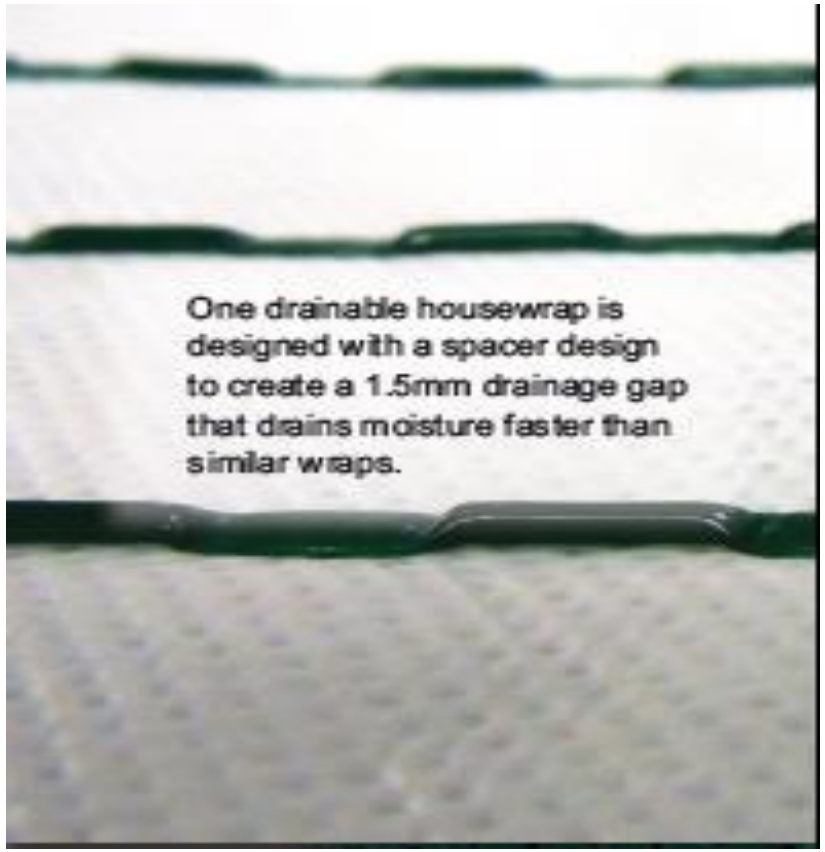
Select a wrap that facilitates rapid drainage to prevent water absorption that meets ASTM E2273

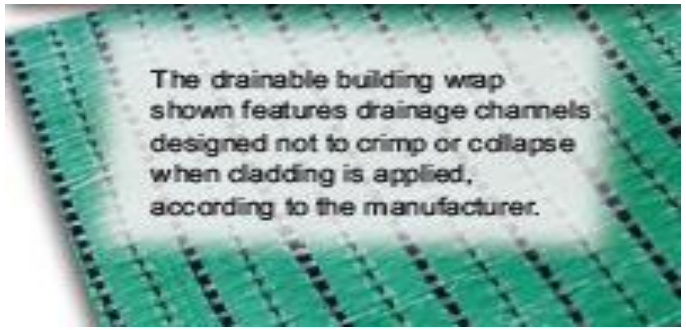
Select a wrap that allows for drying

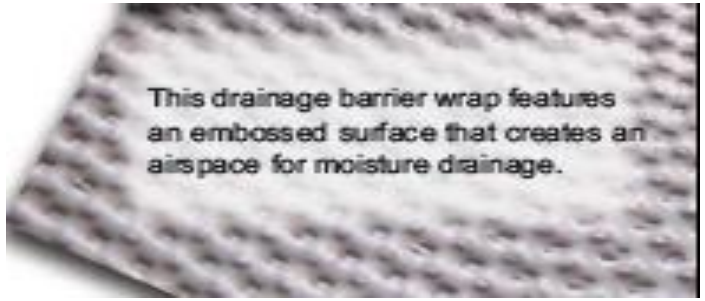


Drainable Walls

Great ROI with added protection for relatively minor cost increase

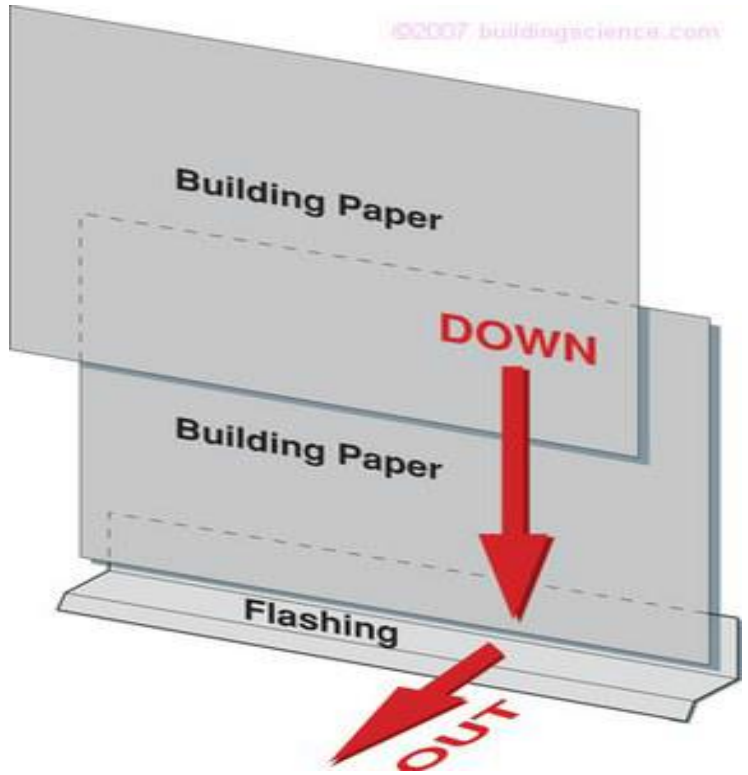






Drainable Walls

- WRB must be installed properly to divert water away from the wall assembly
- **Never** Reversed Shingled
- Start wrap at base of wall
- Tape all seams



Climate Conditions that Warrant a Rainscreen Wall

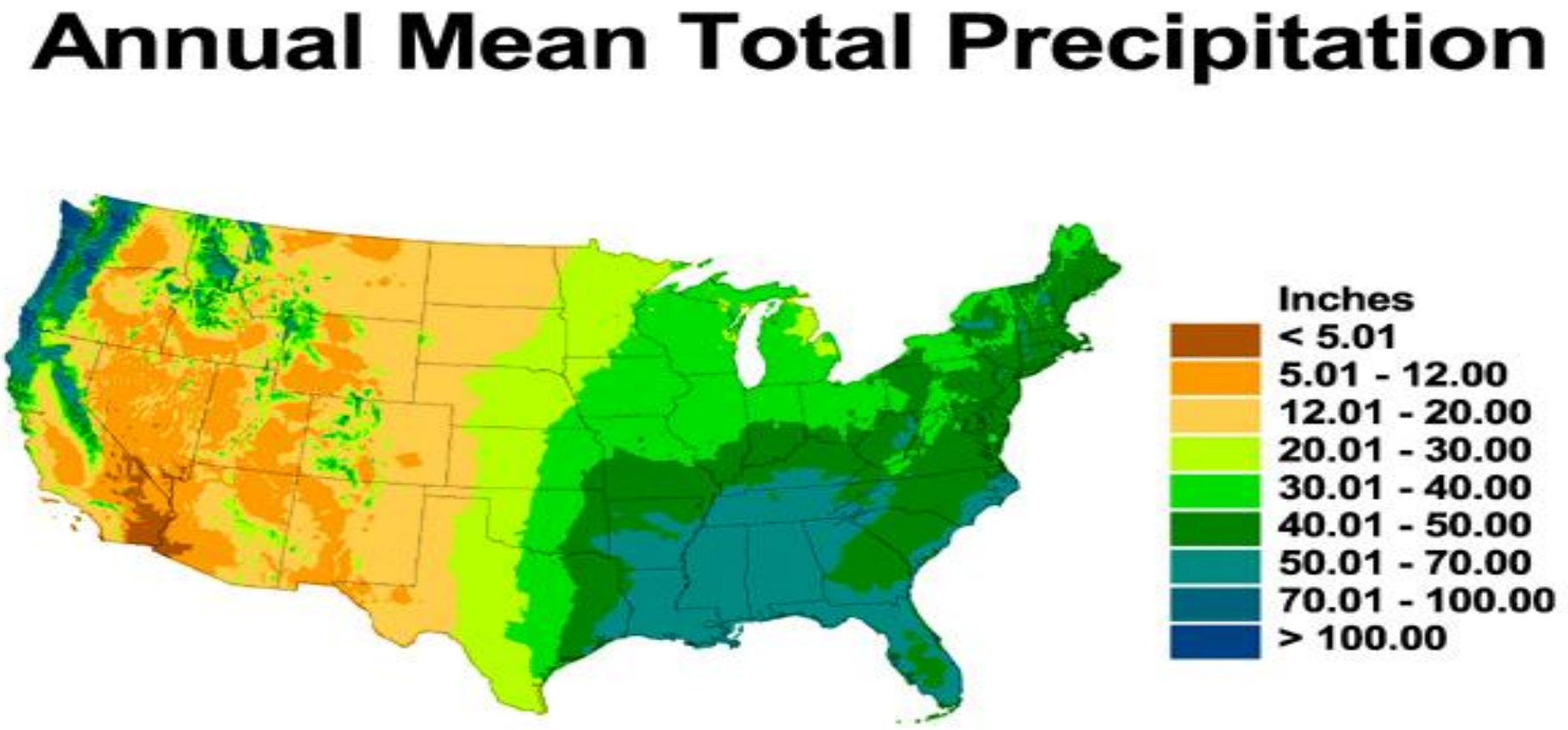
Q: What is the minimum annual rainfall that would be a cutoff for advising the use of a rainscreen?

A: Any area receiving more than **20” of annual rainfall** should incorporate enhanced drainage techniques (Drainable Housewrap) in the wall system, especially if using an absorptive/reservoir cladding material. Areas receiving **40” of annual rainfall** should utilize a rainscreen design regardless of cladding material.

(Building Enclosure Moisture Management Institute)

BEMMI
Building Enclosure Moisture Management Institute

Climate Conditions that Warrant a Rainscreen Wall

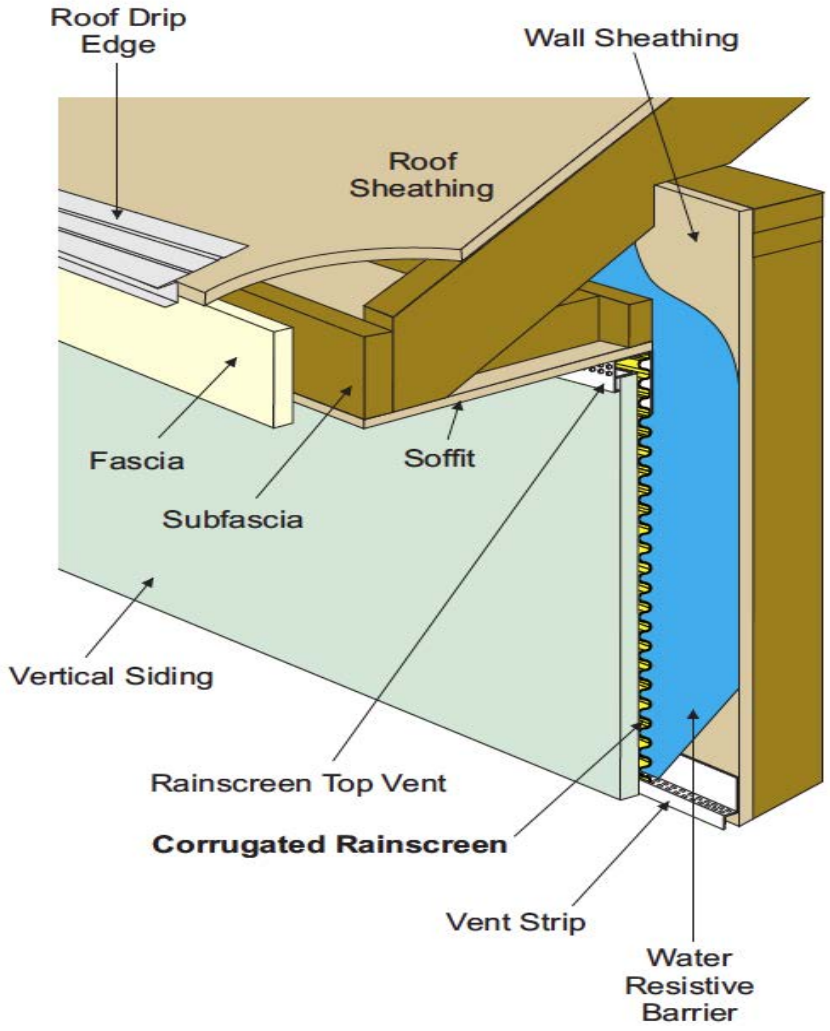


Rainscreen Walls

Considered Best Practice

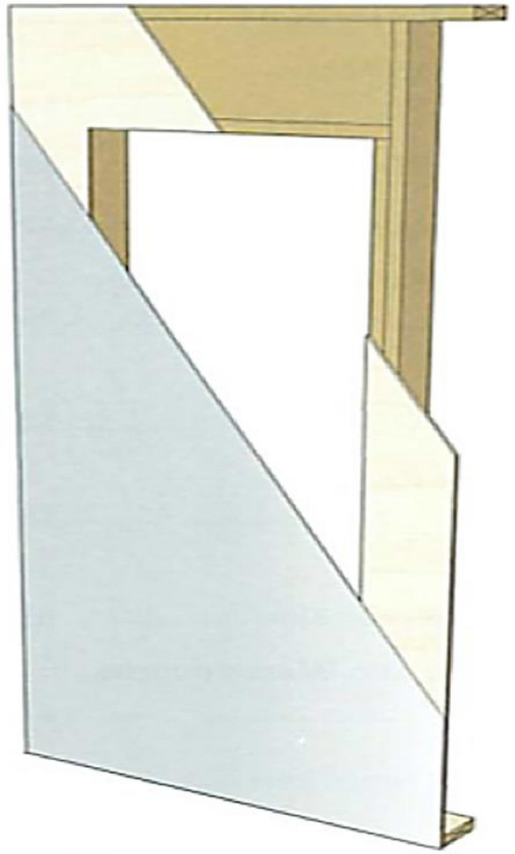
Differ from drainable walls as they have an airspace between WRB and cladding to promote greater drying as well as drainage

- Typical air space range from ¼” to 1”
- Rainscreen products typically plastic or wood



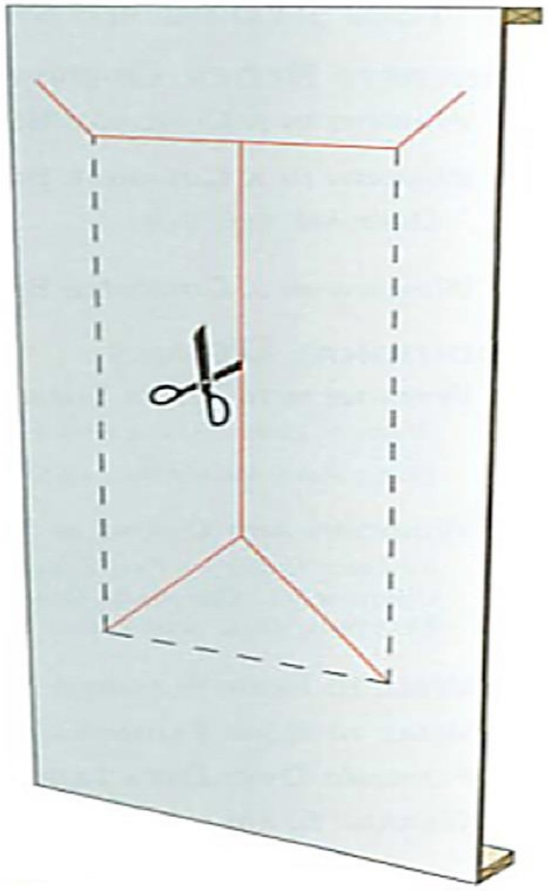
Rainscreen Walls

Flashing for Window Openings – ASTM E2112



Step 1
Wood frame wall with OSB and housewrap

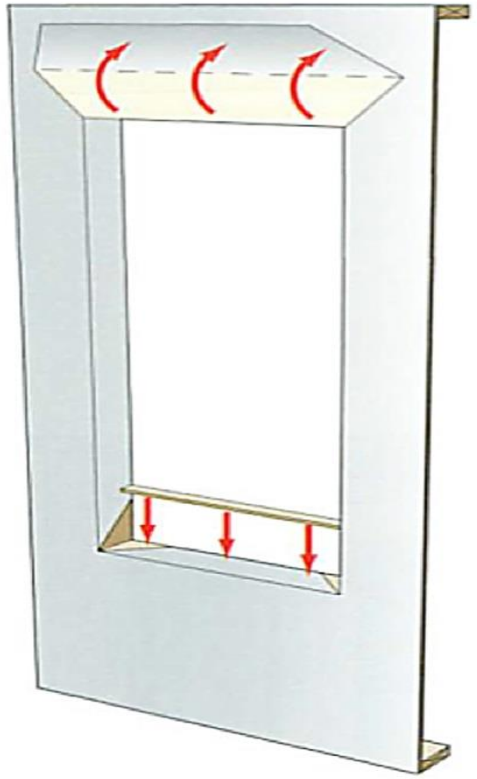
Flashing for Window Openings – ASTM E2112



Step 2
Modified "I" cut in housewrap

Here is the first big change as before most commonly you had an X cut which has been replaced.

Flashing for Window Openings – ASTM E2112



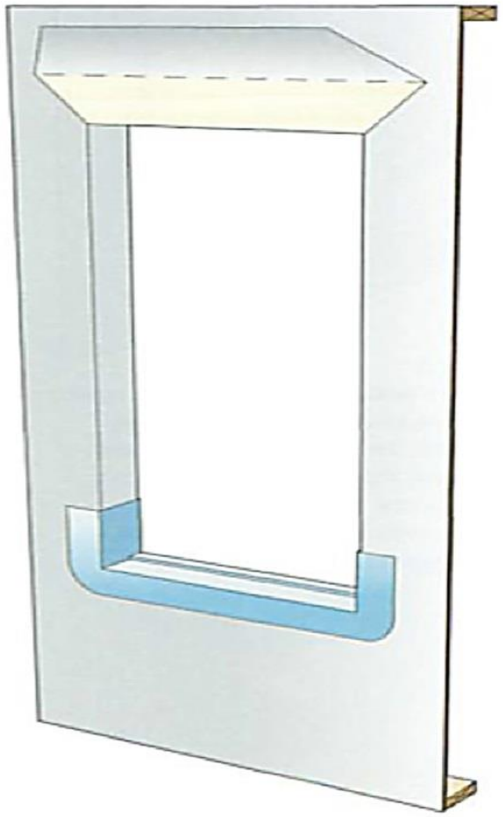
Step 3
Fold housewrap in at jambs and sill; Housewrap at head temporarily folded up or, alternatively, tucked under; Install backdam

Second major change is the flap at the head of the window, which is achieved with angled cuts away from the corner.

This allows for the integration of the self adhered flashing and drip cap to the sheathing and creating a positive shingle install.

At the base you also see the installation of a back dam which can be achieved in a variety of ways

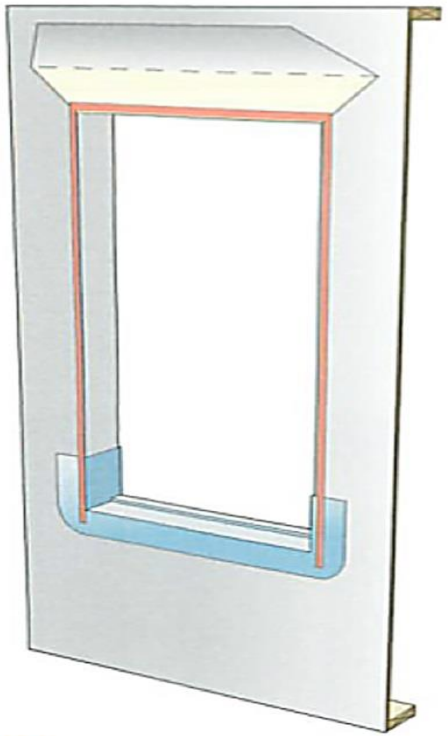
Flashing for Window Openings – ASTM E2112



Step 4
Install formable flashing at sill per manufacturer's instructions; Use care in forming around backdam and corners

This version shows formable flashing such as a flex tape but I can supply you for detailing using straight flashing tape or a manufactured pan.

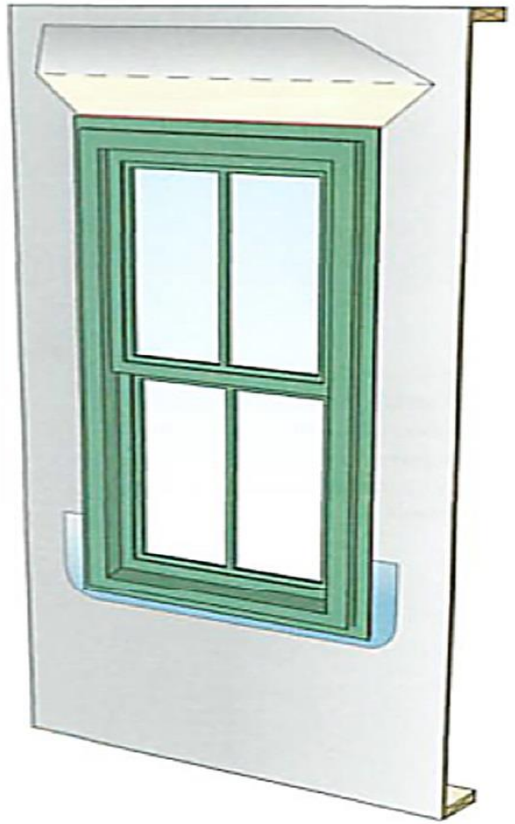
Flashing for Window Openings – ASTM E2112



Step 5
Apply sealant at jambs and head; Alternatively, sealant can be applied to the back side of the nailing flange (back-caulked); Sealants, housewraps and flashings must be chemically compatible

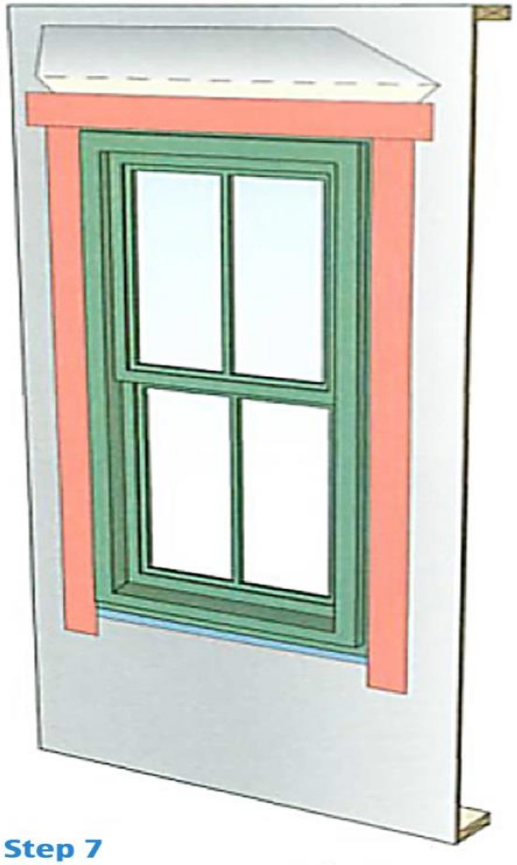
Important to note that sealant is only placed on the jambs and head of window or opening. Allows for drainage at the base.

Flashing for Window Openings – ASTM E2112



Step 6
Install window plumb, level and square per manufacturer's instructions

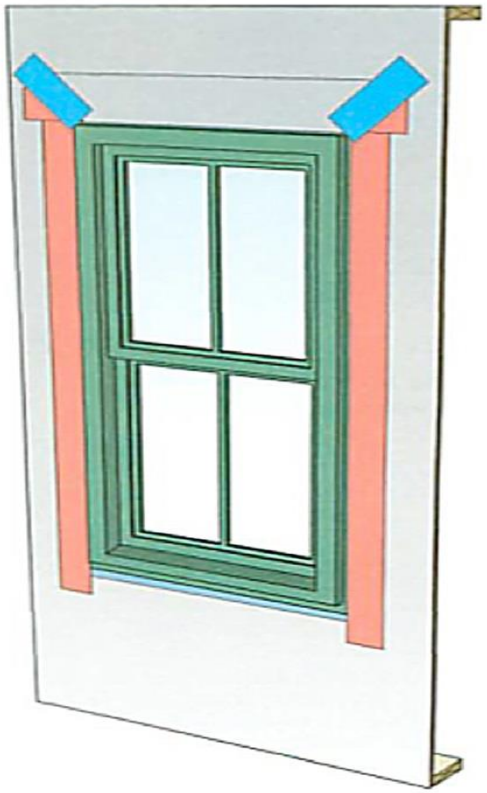
Flashing for Window Openings – ASTM E2112



Step 7
Install jamb flashing; Install a drip cap (if applicable); Install head flashing

Shingle fashion installation with the jambs overlapping the sill flashing then the head over the jambs.

Flashing for Window Openings – ASTM E2112



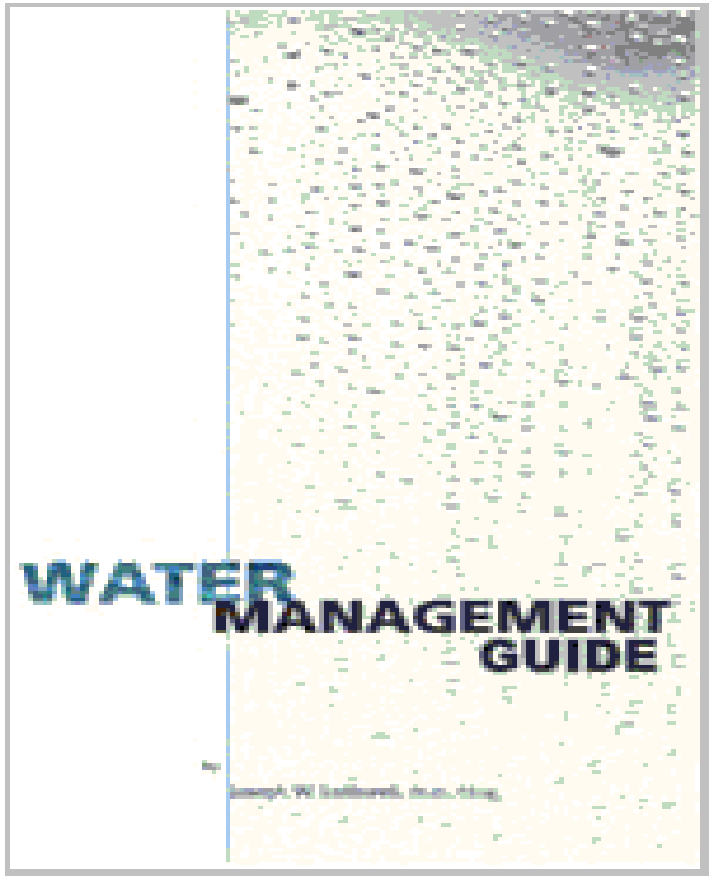
Step 8
Fold housewrap down at head; Tape head flashing; Air seal window around entire perimeter on the interior with sealant or non-expanding form

Here the flap cut in step 2 and 3 is brought over the head flashing for positive shingle fashion integration of window.

Flashing for Window Openings – ASTM E2112

EEBA™

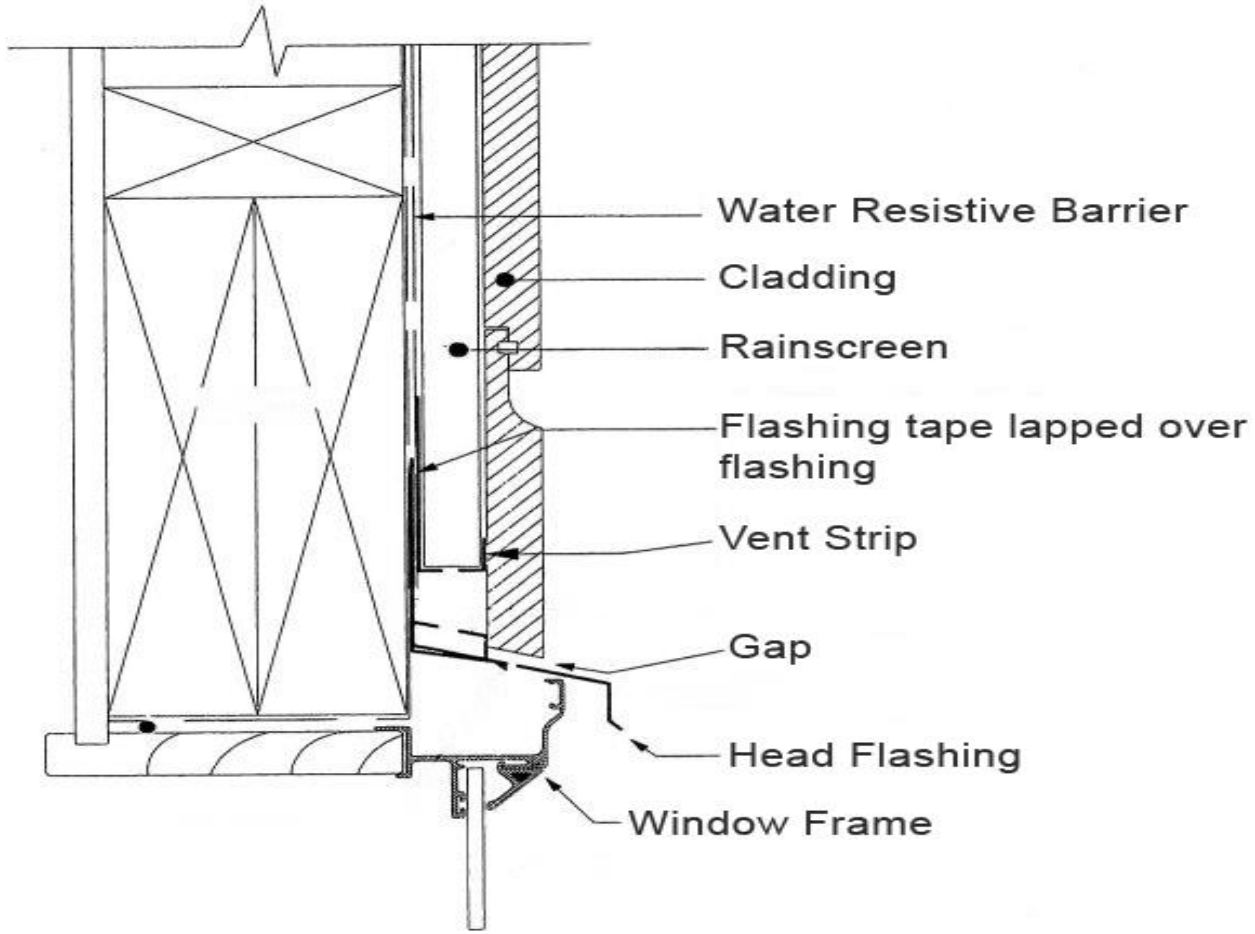
Energy & Environmental Building Alliance



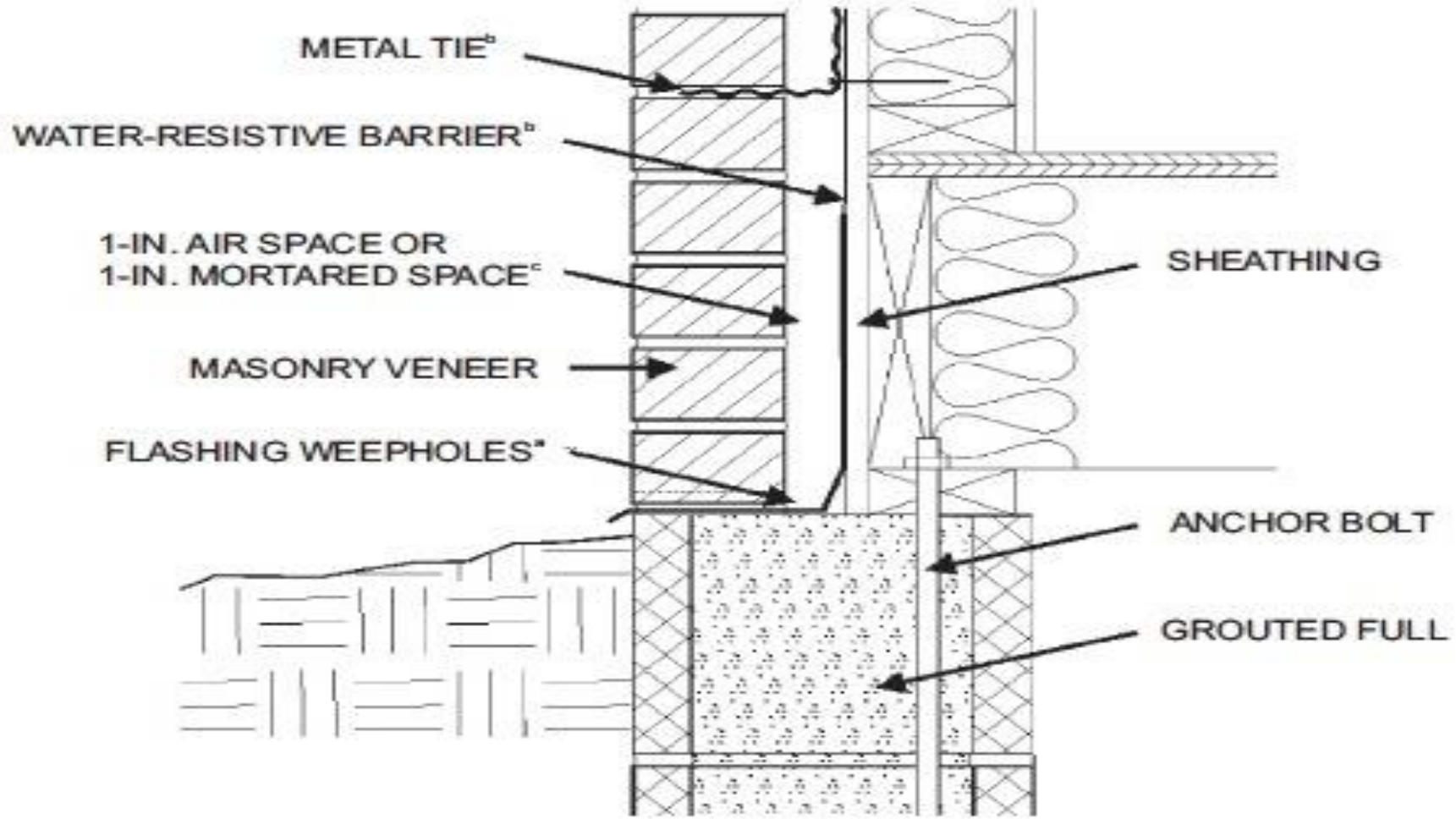
Flashing for Window Openings – ASTM E2112

Flashing for Window Openings – ASTM E2112

Thru-wall Flashing for Window Head



Code Required Thru-wall Flashing Base of Wall



Sustainable Design Goals

Design the structure and **flashings** to deflect water
Design wall assembly to drain water behind claddings as rapidly as possible
Select a **drainable housewrap** that promotes drying
Flash window openings to ASTM E2112 requirements
Use thru-wall flashings at cladding transitions, openings and base of the wall
Seal all penetrations and inspect **before** cladding

Thank you!