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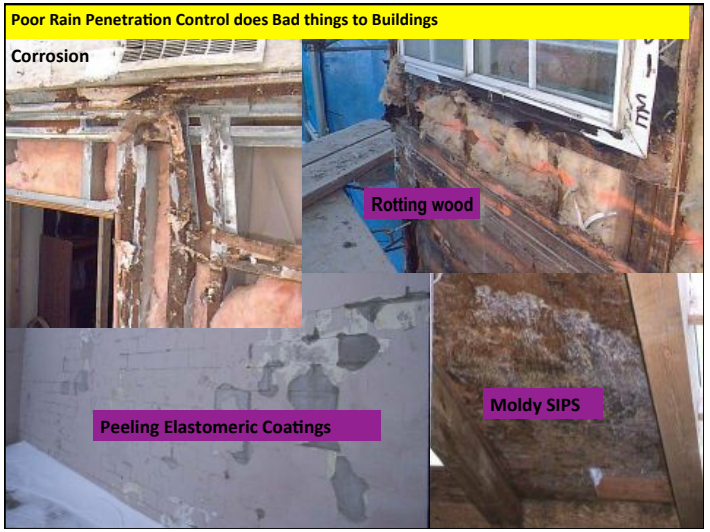
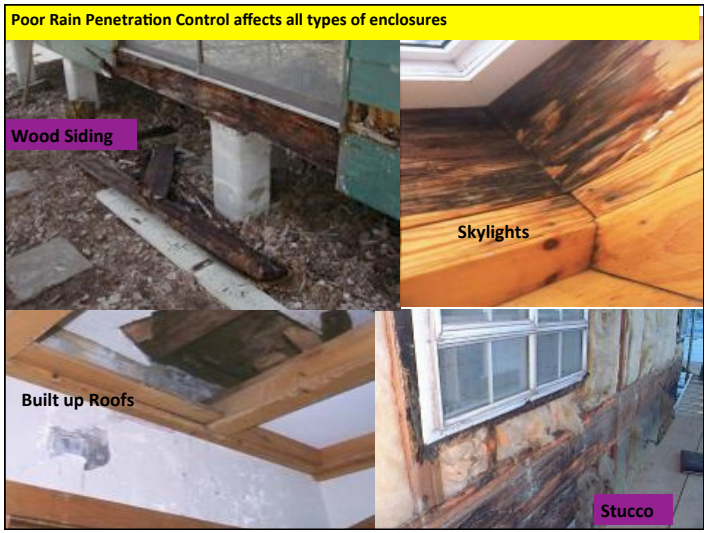
Learning Objectives

- Understand Rain Control Risk Factors
- Assess different strategies of rain deflection
- Be able to understand the 3 rain control strategies for enclosures
- Be introduced to some details

Rain Rain Go Away

Dr John Straube P.Eng.
Building Science Corporation
University of Waterloo





Rain

- Rain is the largest source of wetting
- We need to reduce wetting because
  - we have better insulation and airtightness
  - the materials are often less tolerant of wetting

Rain Penetration Control

- How much rain control do you need?
- Depends on
  - Climate
  - Site
  - Building height and massing
  - Surface features
  - Chosen enclosure wall strategy

Risk Factors

Risk	Relationship to Rain-Penetration Problems
Rainfall	As the amount of rainfall increases, the risk increases
Exposure	As the exposure to rainfall increases, the risk increases
Shape and Surface	As shape and surface features increase rain deflection and shedding respectively, the risk decreases
Water Penetration Resistance	As the water penetration resistance of the assembly increases, the risk decreases
Moisture Tolerance of Assembly	As the moisture tolerance of the materials that comprise the assembly increases (e.g., masonry and concrete vs. wood and steel) the risk decreases
Drying Potential	As the ability of an assembly to dry increases due to the climate, design, or both, the risk decreases
Workmanship	As craftsmanship, inspection, & testing of the construction quality increases, risk decreases

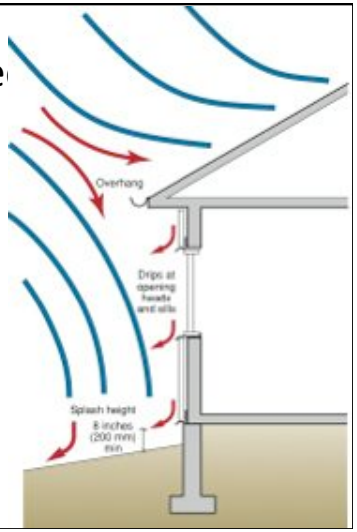
3D's of Controlling Rain Leaks

- *Deflection*
  - reduce water on building
  - redirect water away
  - slope surfaces, use flashing
- *Drainage / Exclusion / Storage*
  - enclosure design
  - provide drainage, or storage, or barrier
- *Drying*
  - allow any remaining water to dry by diffusion & ventilation

DEFLECTION

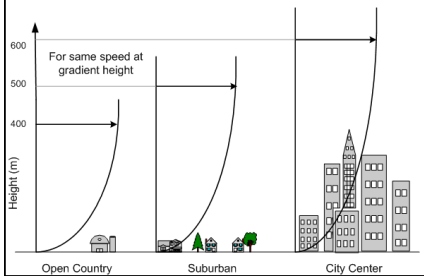
Defle

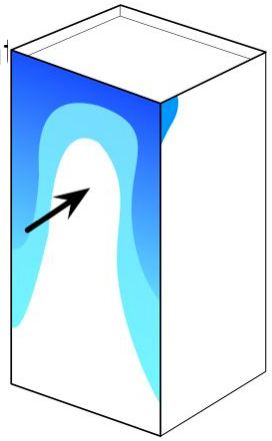
- **Site (trees, buildings etc)**
- **Building massing**
- **Overhangs**
- **Surface features**
- **Base/site**

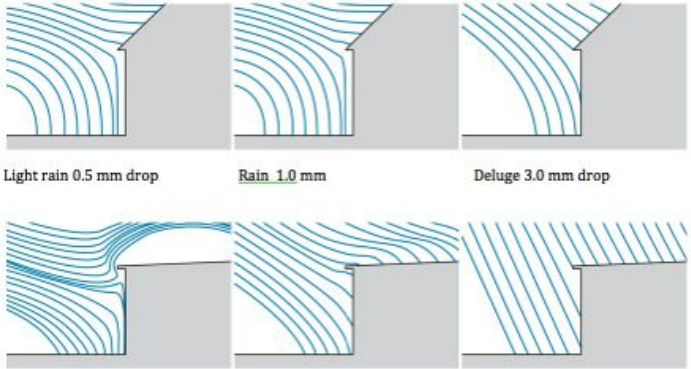


Exposure Ma

- High-rise bldgs exposed to much higher wind & rain

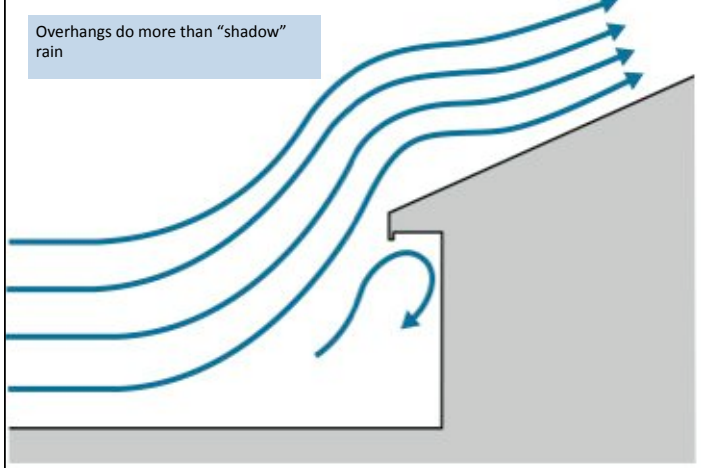






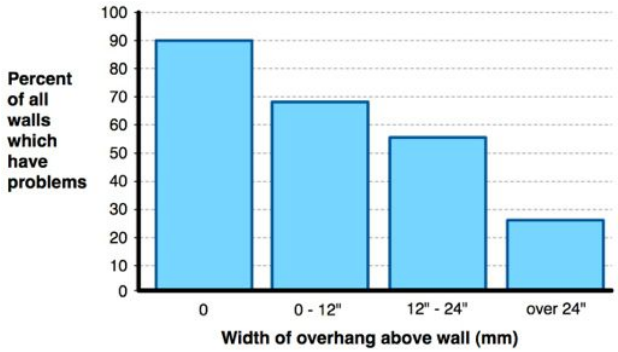
Roof shape helps deflect rain around building

Building Science Rain Control 13



Building Science Rain Control 14

Overhangs help, esp. on low-rise



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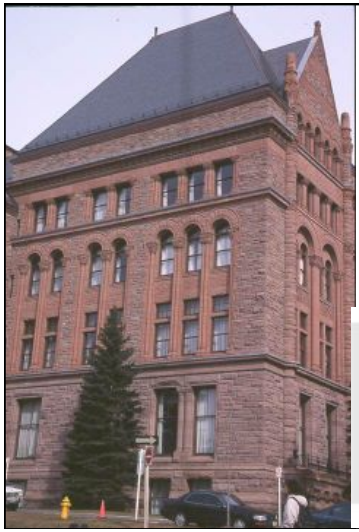
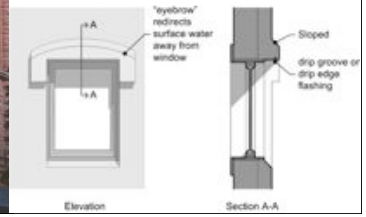


- **Old Building- multi-story, old windows**
- **Control Rain on the Surface**
- **Multiple shedding, drips, etc**
- **Reduced rain load on joints and openings**

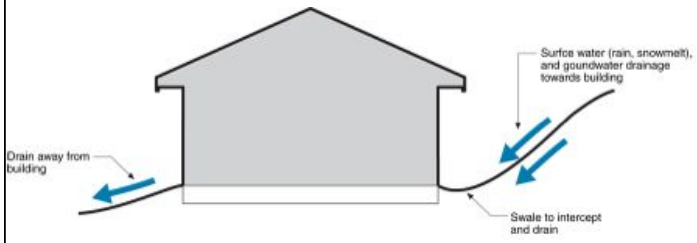



Surface Features:
Protect Wall Openings


Forbidden City
Southern Germany
Lake Baikal
COURT...HOUSE
New Zealand


Modern Buildings often do not respect need for surface drainage
Difference?
Rain Concentrator

Surface Water and Splashback



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– Rain Control 21

Modern concrete sill with generous jamb extensions and groove cut to form a lower drip edge

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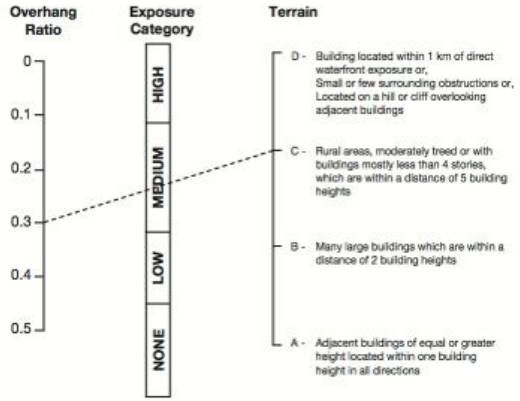
Rain Control 22

Exposure Matters!



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Drainage / Exclusion / Storage

ENCLOSURE STRATEGIES

Enclosure Wall Strategies

- As some rainwater is likely on the wall
- Water can penetrate in many ways

Once rain is on the wall …

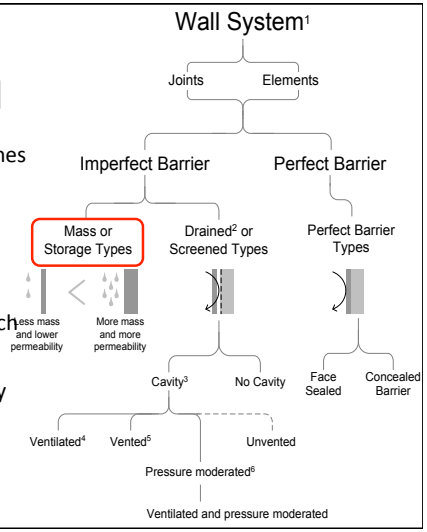
- **Drainage**
- **Exclusion**
- **Storage**

Enclosure Strategies

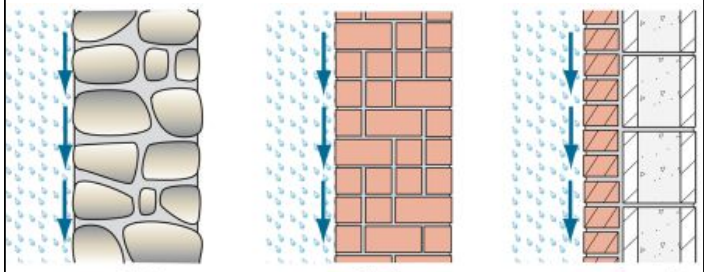
25

Rain Control

- Three possible approaches
  - Mass
  - Drained
  - Perfect Barriers
- Element and joint can be different approach
- Perfect Barriers are risky



Storage/Mass Walls



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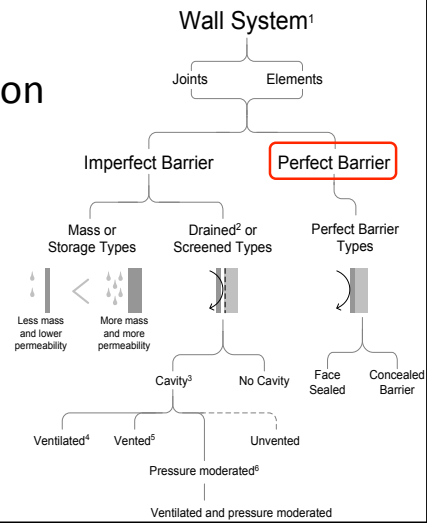
Rain Control 27

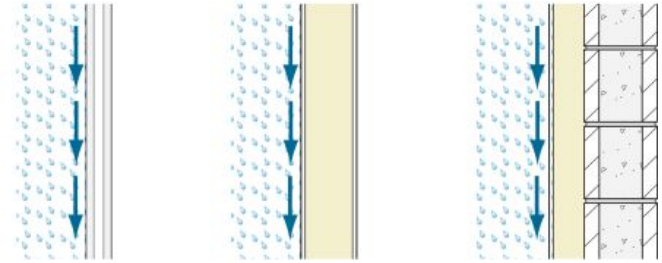
Renovating / Change

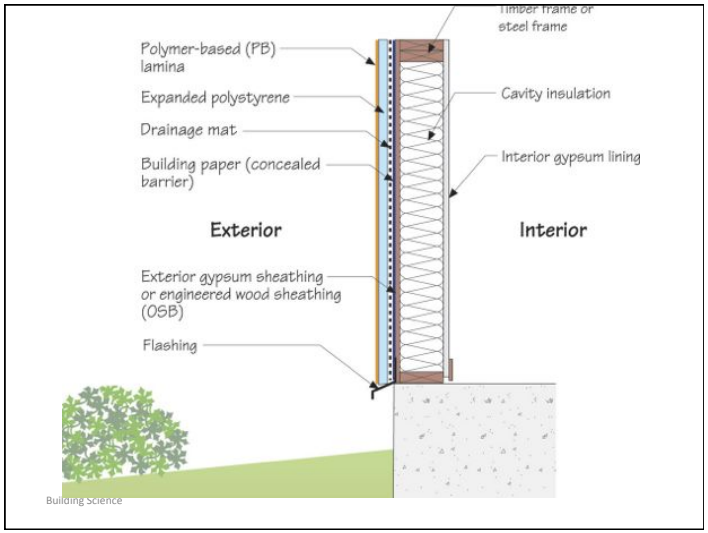
Categorization



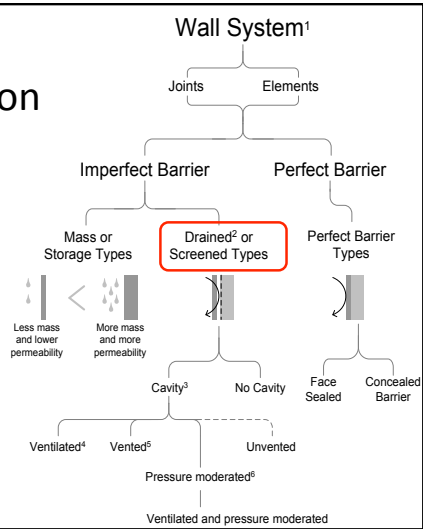
Perfect Barrier

- Highly dependent on workmanship
- Field joints tend to leak (if exposed sealant)



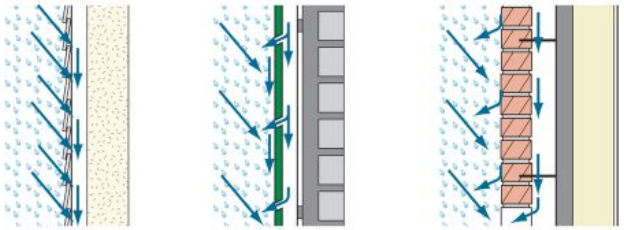


Categorization



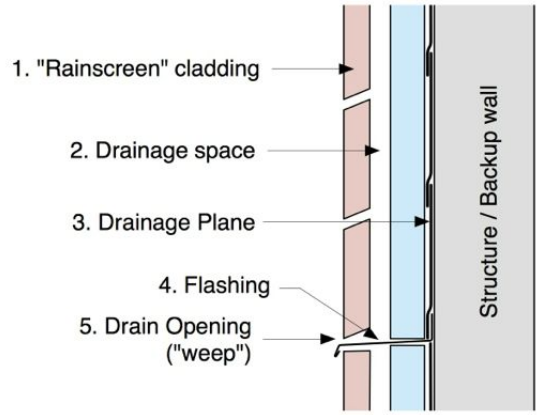
Drained Walls

- Drained systems preferred
- Account for joints and penetrations as well as installation defects and material failure



Claddings that leak

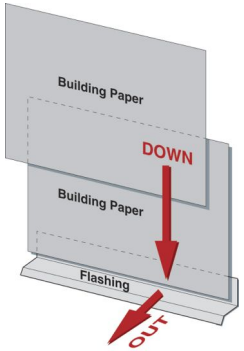
- Brick
- Stucco
- Wood, vinyl, fiber cement
- Adhered veneer
- EIFS
- Metal panels, metal roofs
- Shakes, shingles



Requirements Drained Walls

- Drainage plane
  - Water repellent, continuous
- Drainage gap
  - Even 1 mm (<1/16") is enough!
- Flashing
  - Waterproof to direct water outward
- Weep holes
  - Above grade

Lapped Housewrap, paper



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Rain Control 41

Traditional Drainage Plane

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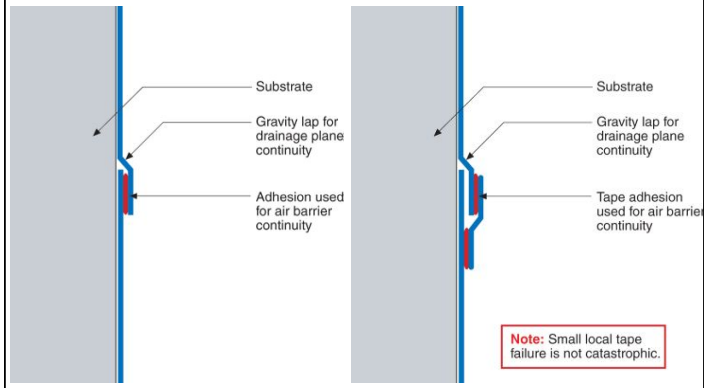
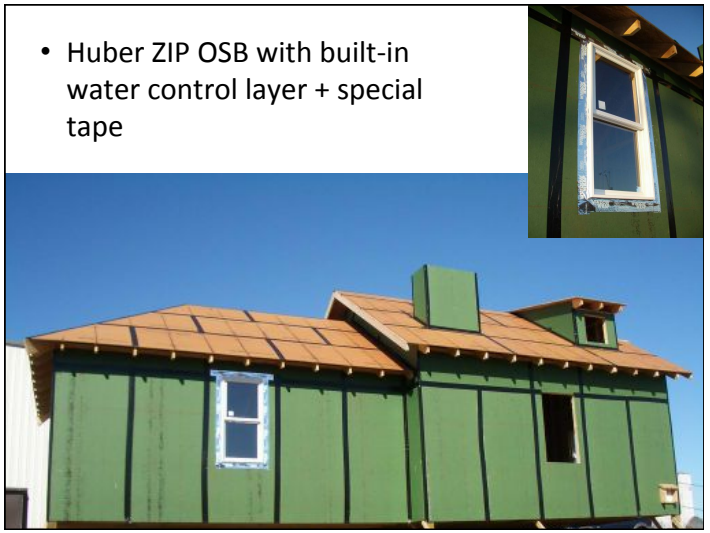
Laps are the most reliable




• Taped Foam
Building Science
Rain Control 45

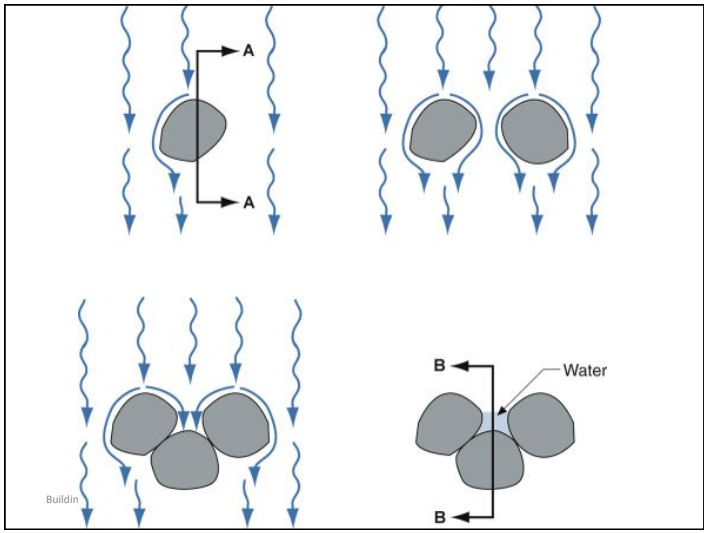

• Huber ZIP OSB with built-in water control layer + special tape

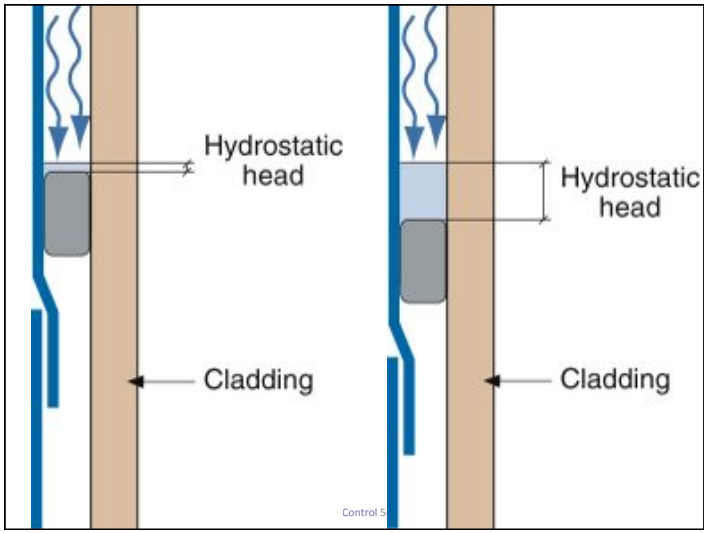

Laps are still the most reliable
Avoiding Fishmouths
Rain Control 47

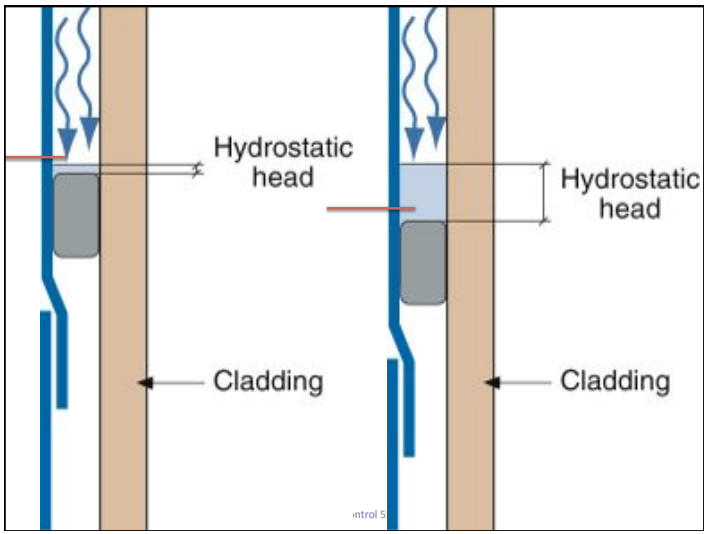
Drainage Gaps

- Gap avoids hydrostatic pressure
  - drains away water
  - Requires only small gap, e.g. 1/16”
- Reduces time of wetness on housewrap sheathing membrane
- *May* allow ventilation drying if >1/8”-1/2”

52


A
A
B
Water
B


Hydrostatic head
Hydrostatic head
Cladding
Cladding


Hydrostatic head
Hydrostatic head
Cladding
Cladding

Drained gap behind brick

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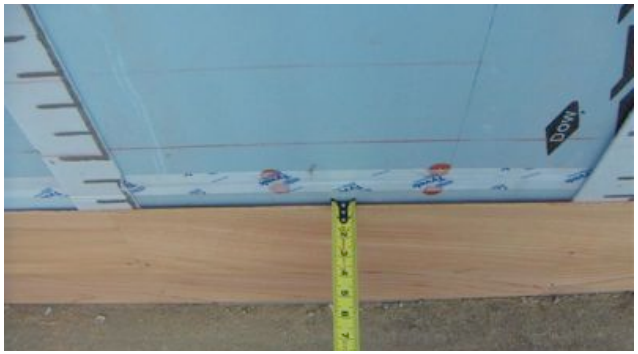
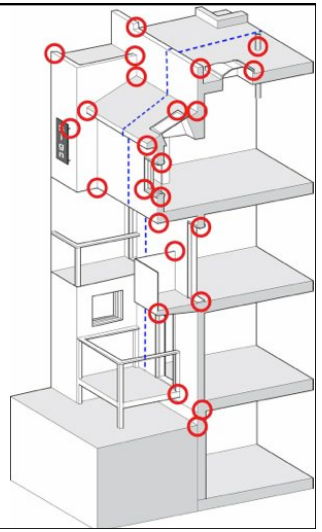
Thin strips behind wood



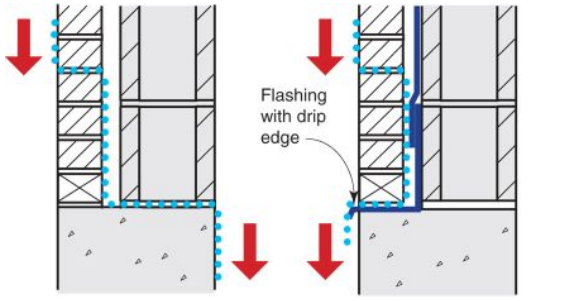
Enclosure Design: Details

- Details demand the same approach as the enclosure.
- Scaled drawings required at ◯



Building Science.com 60/175

Base Flashing

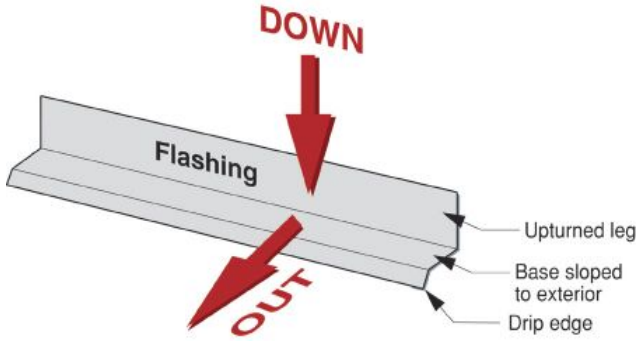


Rainwater can flow downward through openings, cracks and cavities driven by gravity.

Flashings and drainage plane direct gravity flow back towards the exterior.

1

Base Flashing: Waterproof

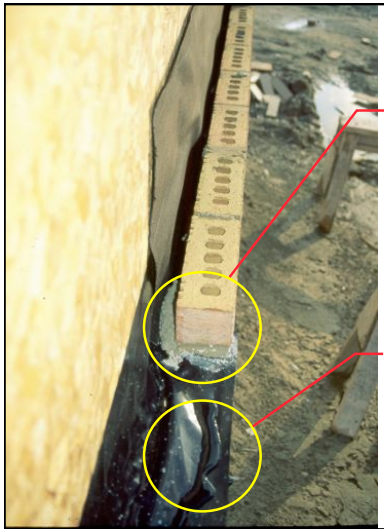


Building Science 2008

Joseph Lstiburek – Rain Control 62

Building Science

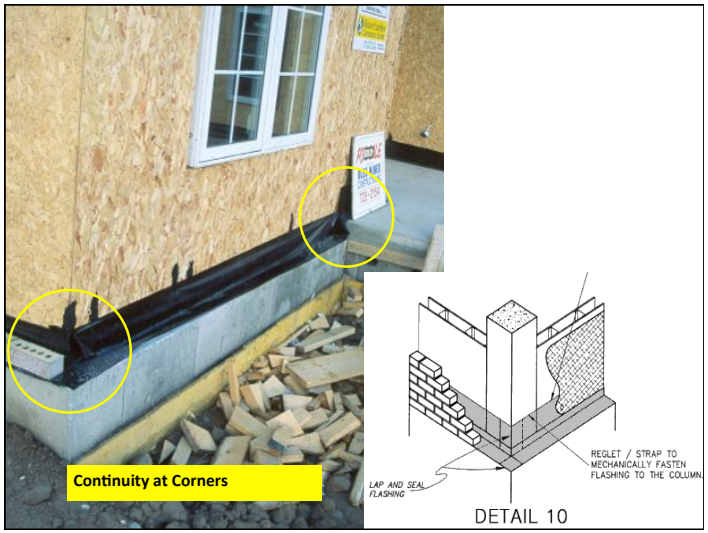
Rain Control 63

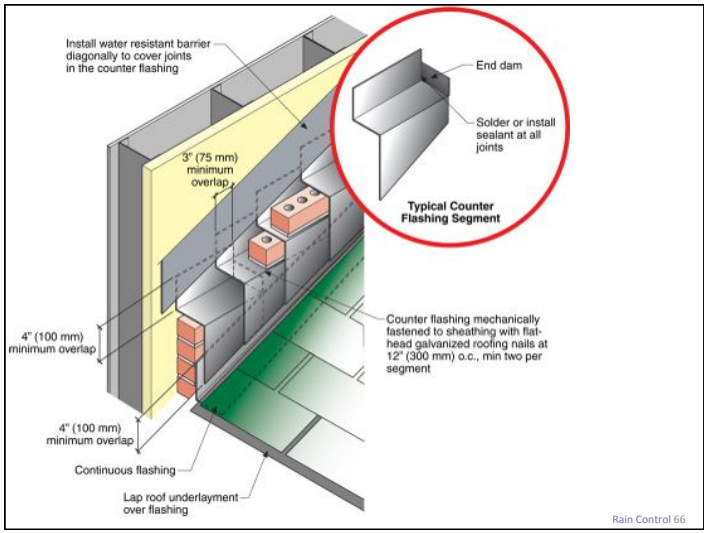


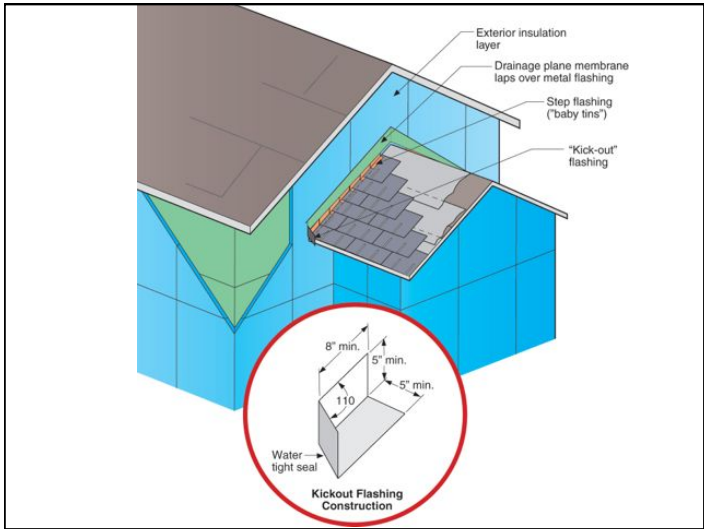
Water can build up here -- we need a waterproof barrier

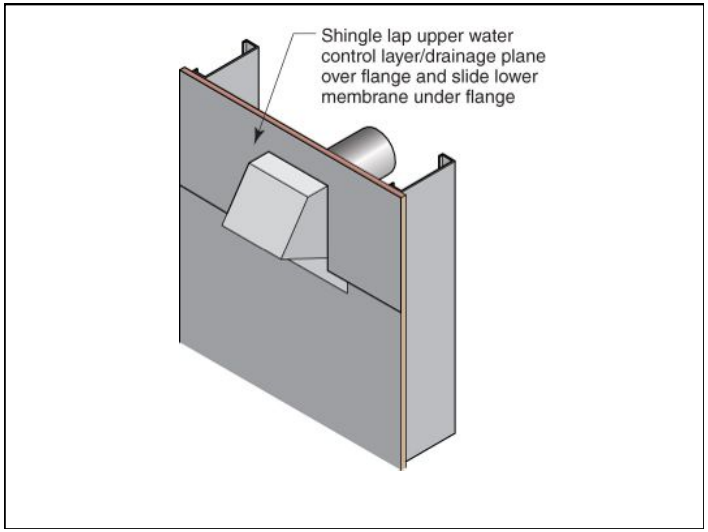
Note standing water

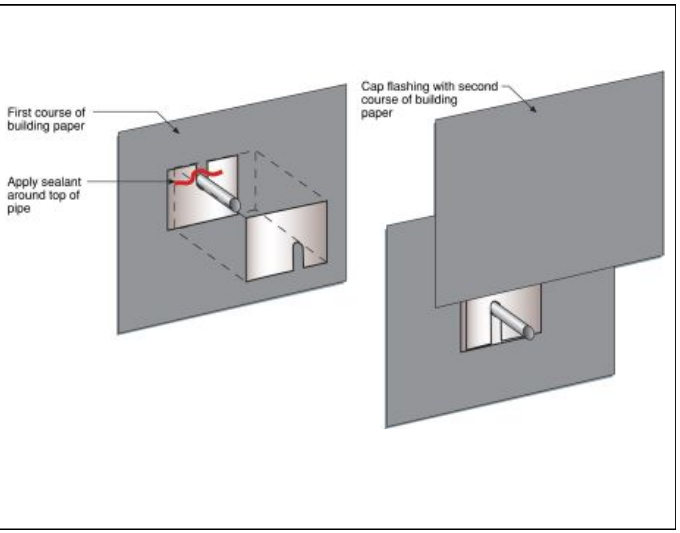
64


Continuity at Corners
REGLET / STRAP TO MECHANICALLY FASTEN FLASHING TO THE COLUMN.
LAP AND SEAL FLASHING
DETAIL 10

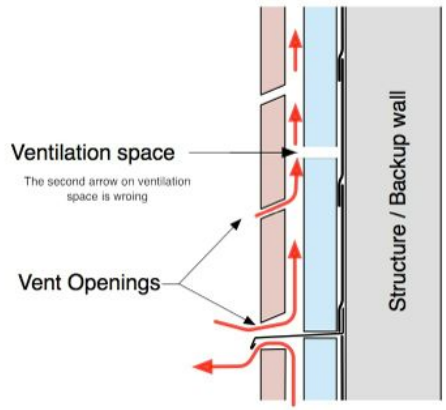

Install water resistant barrier diagonally to cover joints in the counter flashing
End dam
Solder or install sealant at all joints
3" (75 mm) minimum overlap
Typical Counter Flashing Segment
4" (100 mm) minimum overlap
Counter flashing mechanically fastened to sheathing with flat-head galvanized roofing nails at 12" (300 mm) o.c., min two per segment
4" (100 mm) minimum overlap
Continuous flashing
Lap roof underlayment over flashing
Rain Control 66

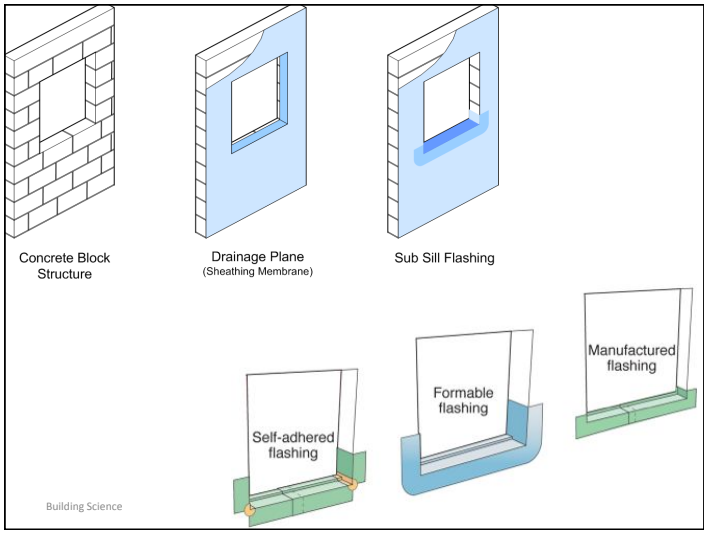

Exterior insulation layer
Drainage plane membrane laps over metal flashing
Step flashing ("baby tins")
"Kick-out" flashing
8" min.
5" min.
5" min.
110
Water tight seal
Kickout Flashing Construction

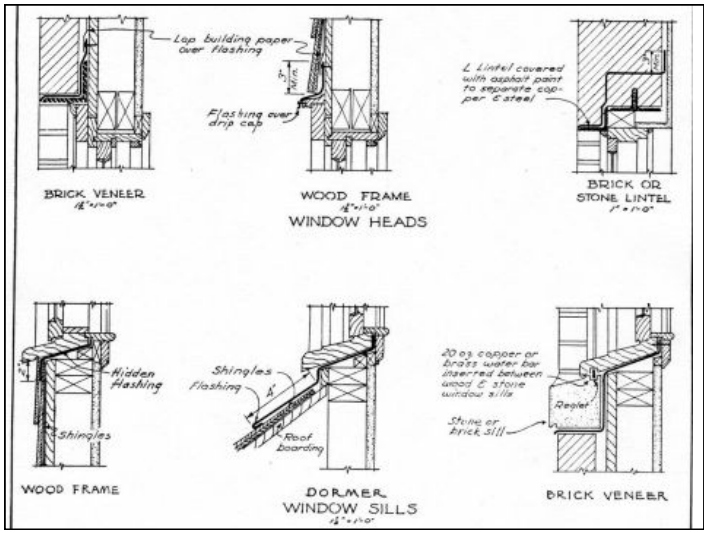

Shingle lap upper water control layer/drainage plane over flange and slide lower membrane under flange

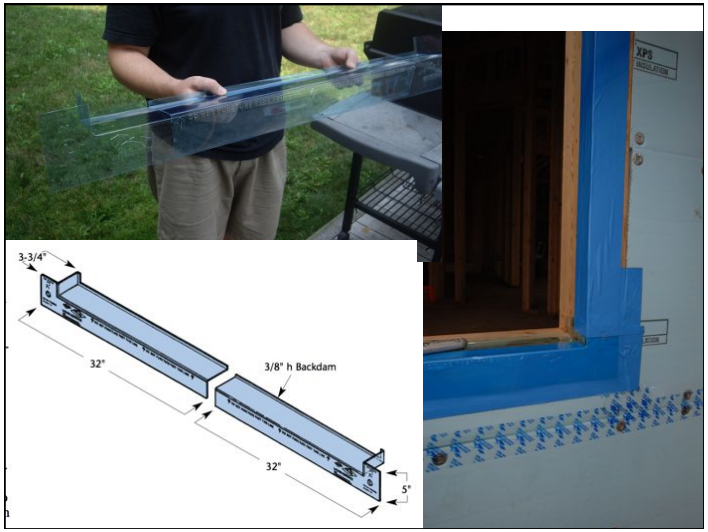


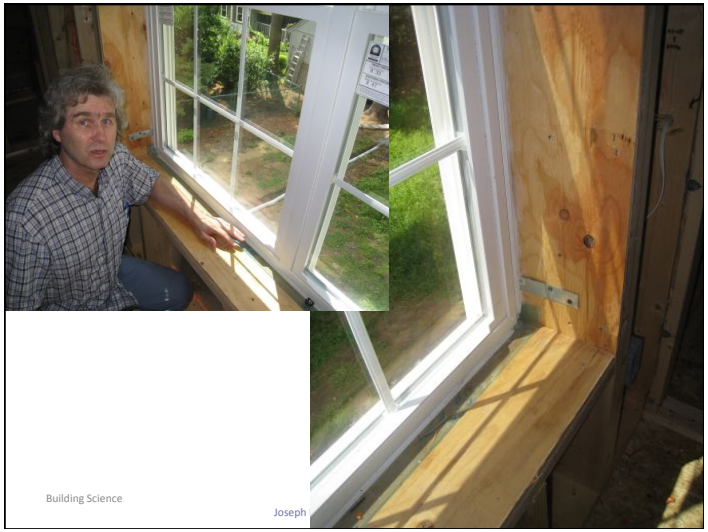
Ventilation helps drying. Not always needed.

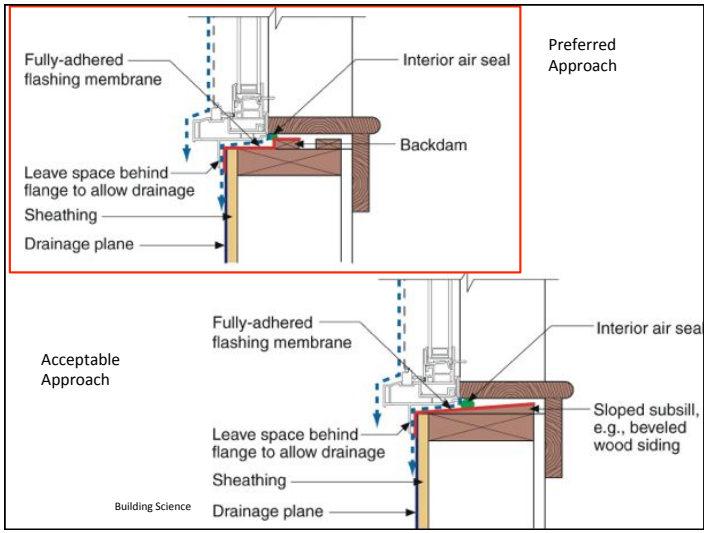



Concrete Block Structure
Drainage Plane (Sheathing Membrane)
Sub Sill Flashing
Self-adhered flashing
Formable flashing
Manufactured flashing
Building Science


Lap building paper over flashing
Flashing over drip cap
L Lintel covered with asphalt paint to separate copper & steel
BRICK VENEER
WOOD FRAME
WINDOW HEADS
BRICK OR STONE LINTEL
Hidden Flashing
Shingles
WOOD FRAME
Shingles
Flashing
Roof Boarding
DORMER WINDOW SILLS
20 oz. copper or brass water bar inserted between wood & stone window sills
Reglet
Stone or Brick Sill
BRICK VENEER

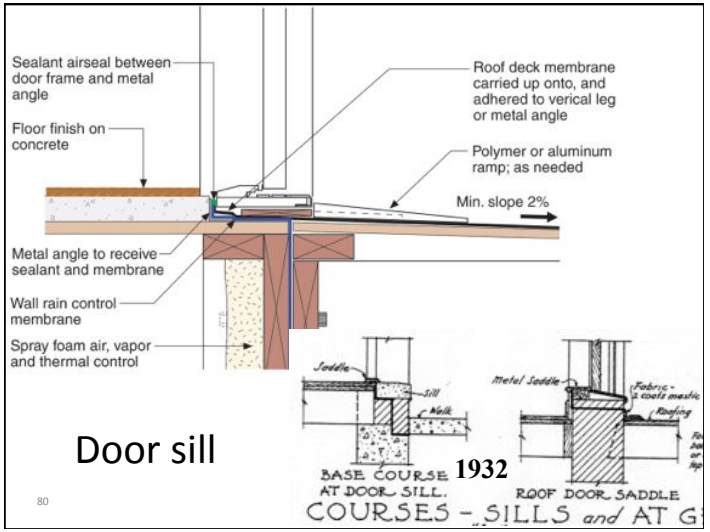

3-3/4"
32"
3/8" h Backdam
32"
5"
XPS


Building Science
Joseph


Fully-adhered flashing membrane
Interior air seal
Backdam
Leave space behind flange to allow drainage
Sheathing
Drainage plane
Preferred Approach
Acceptable Approach
Fully-adhered flashing membrane
Interior air sea
Sloped subsill, e.g., beveled wood siding
Leave space behind flange to allow drainage
Sheathing
Drainage plane
Building Science


Subsill
Building Science 2008
Windows and Curtainwalls No. 7880

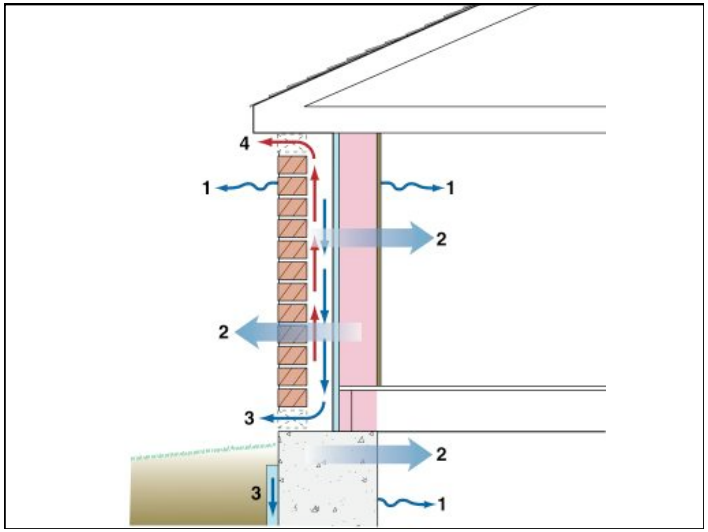

Door Sills
79

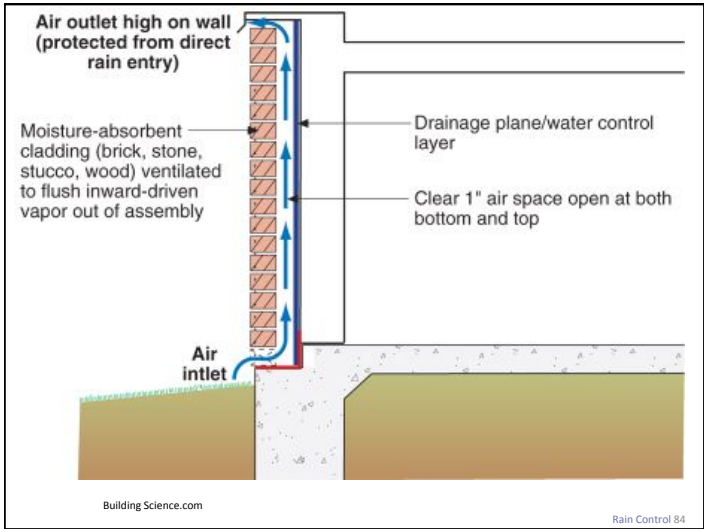

Sealant airseal between door frame and metal angle
Floor finish on concrete
Roof deck membrane carried up onto, and adhered to verical leg or metal angle
Polymer or aluminum ramp; as needed
Min. slope 2%
Metal angle to receive sealant and membrane
Wall rain control membrane
Spray foam air, vapor and thermal control
Door sill
1932
BASE COURSE AT DOOR SILL.
ROOF DOOR SADDLE
COURSES - SILLS and AT G
80

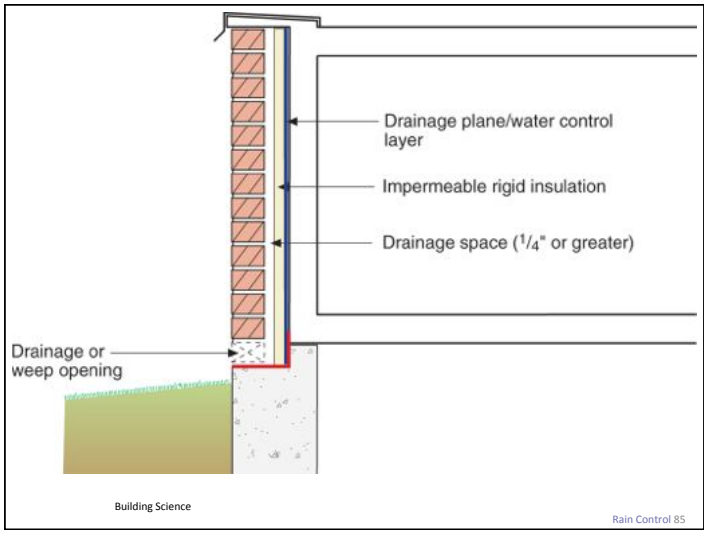
DRYING

Drying

- Complex and involved subject
- Drying capacity depends on
  - Climate (inside and outside)
  - Enclosure design (insulation, ventilation, permeance)
- Extra drying capacity is always good
- Extra drying is not always needed
  - Analysis and judgement required







Conclusions

- Rain Penetration Control is complex
- Should approach it holistically
  - Assess Exposure Risk

Thank you for your time!
Any Questions?

This concludes The American Institute of Architects Continuing Education Systems Program