Design Challenges in Southern Climates

Weighing the risk of different approaches to common conditions

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hot, sunny, and wet

Arrhenius equation

for every 10 degree Celsius
rise the reaction rate doubles

annual rainfall

atlanta: 50 inches
houston: 50 inches
dallas: 40 inches
new orleans: 60 inches
miami: 60 inches
orlando: 50 inches

enclosure problems in hot-humid climates

compromised durability due to damage by heat, UV, and moisture (rain water, ground water, water in air, water in materials)

risk of enclosure failure

for water infiltration to be problematic, the wetting a wall assembly experiences must exceed its capacity to store and redistribute water for long enough to damage the materials that comprise it

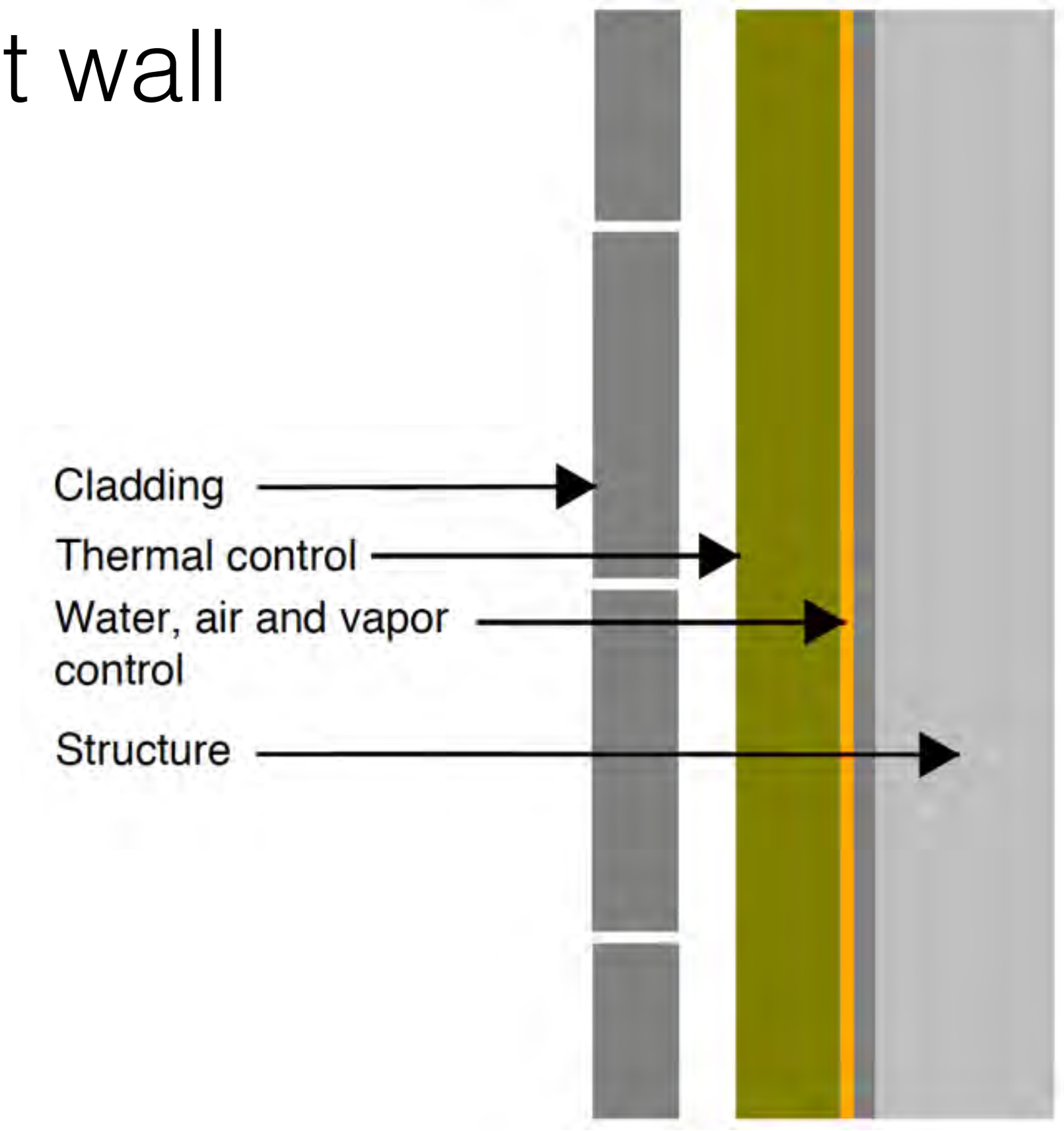
evaluating risk

1. potential pathways
2. the conditions under which water might infiltrate those pathways
    - climate
    - exposure
3. wall assembly's tolerance for wetting
    - drying capacity of the wall
    - moisture sensitivity of the materials that comprise it

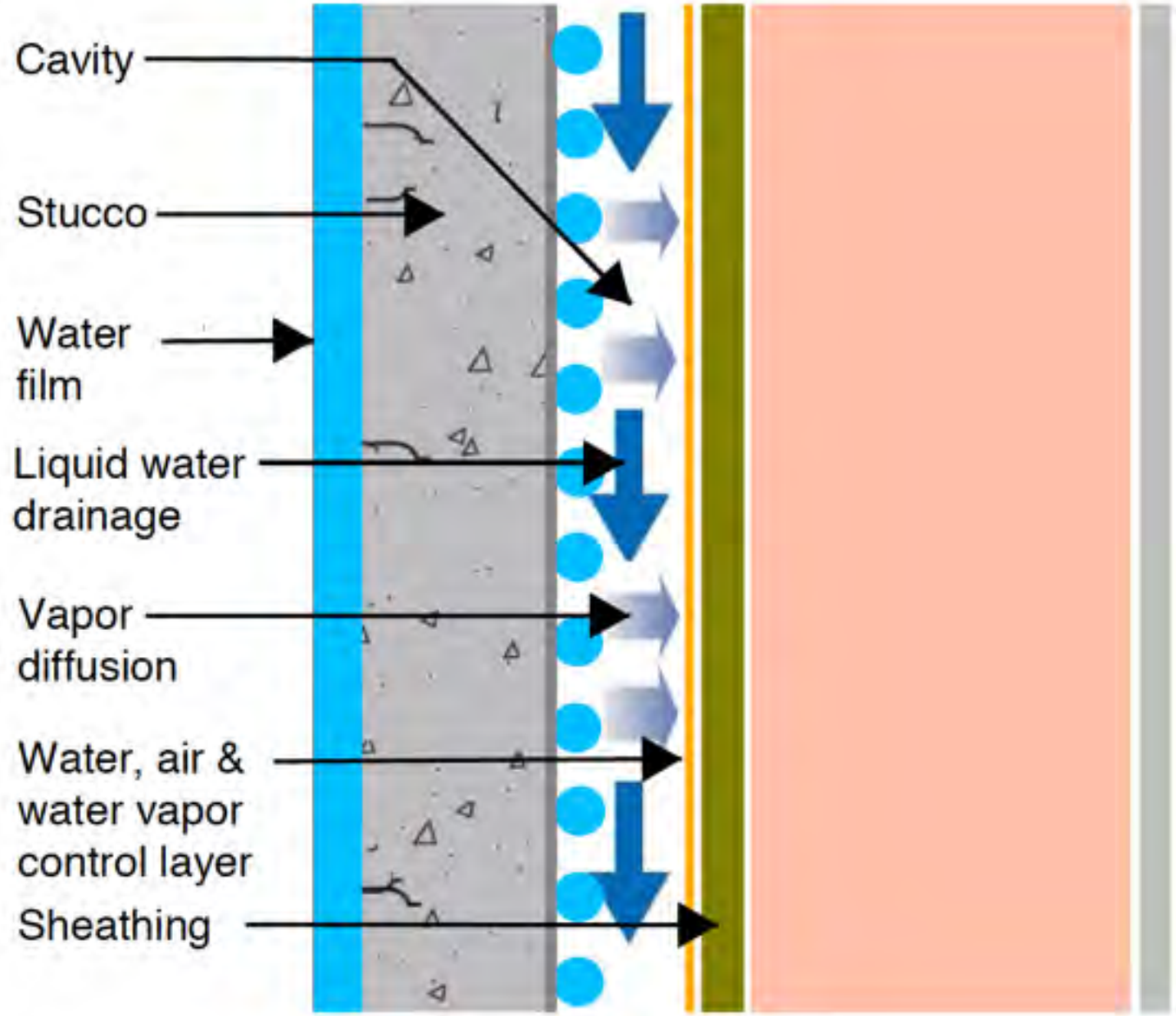
typical areas of compromise

1. stucco assemblies
2. balcony waterproofing systems & details
3. commercial window installation
4. roofing system design

the perfect wall



stucco assemblies



The cavity behind stucco:
(1) provides drainage for liquid water that bypasses stucco through larger cracks & penetrations (relieves hydrostatic pressure)
(2) acts as capillary break and receptor for capillary water, interrupting flow
(3) provides an air gap that facilitates hygric redistribution and moisture removal by air exchange

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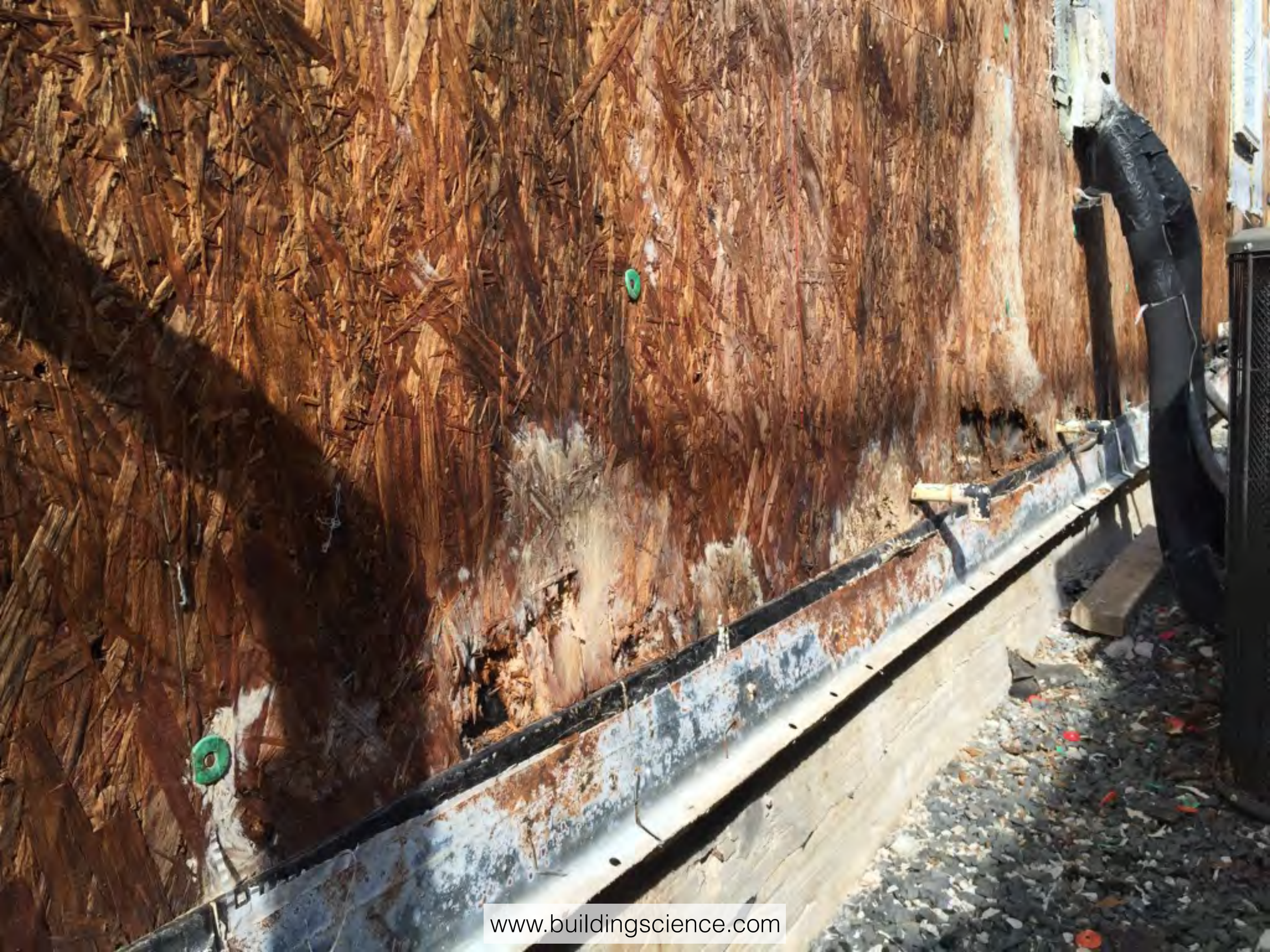

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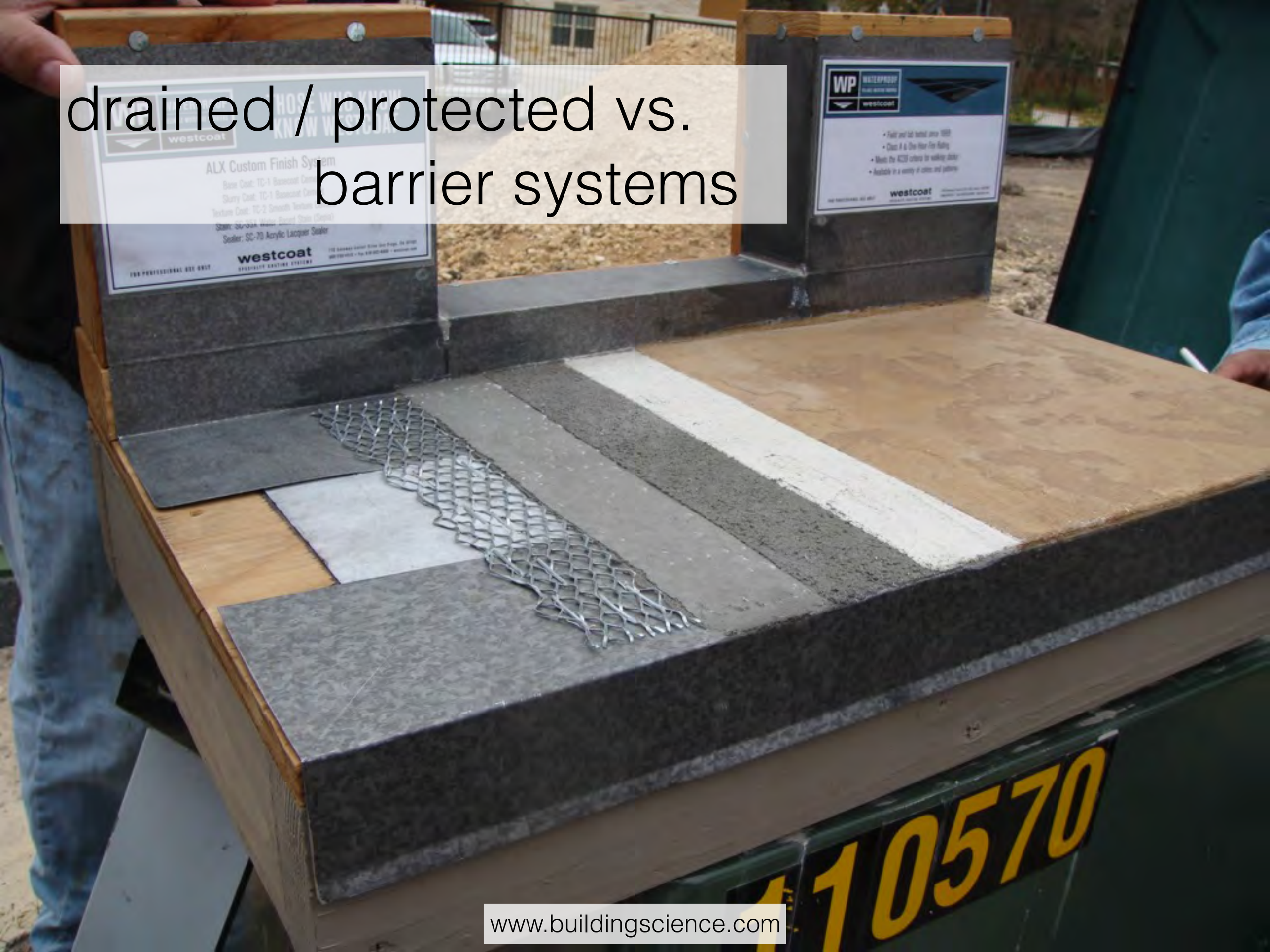
install a drainage mat with stucco and adhered stone claddings on framed walls…

1. in climates that receive more than 20 inches of rain per year
2. for buildings that exceed 2 stories
3. for buildings that are architecturally complex

balcony waterproofing

drained / protected vs. barrier systems



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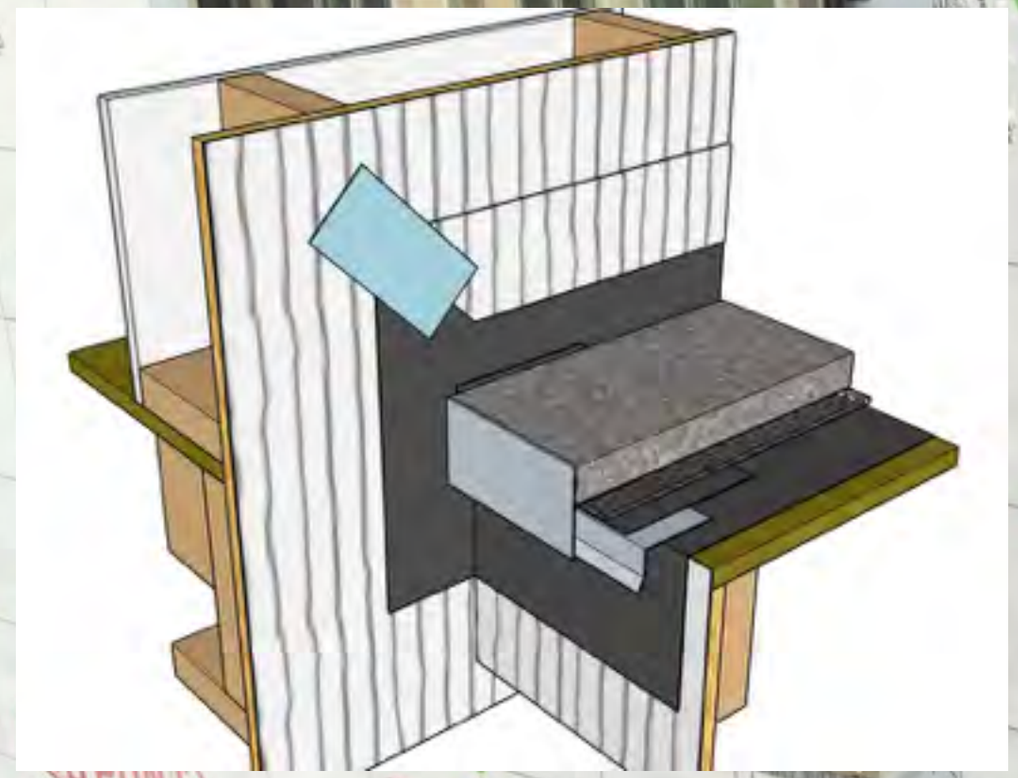

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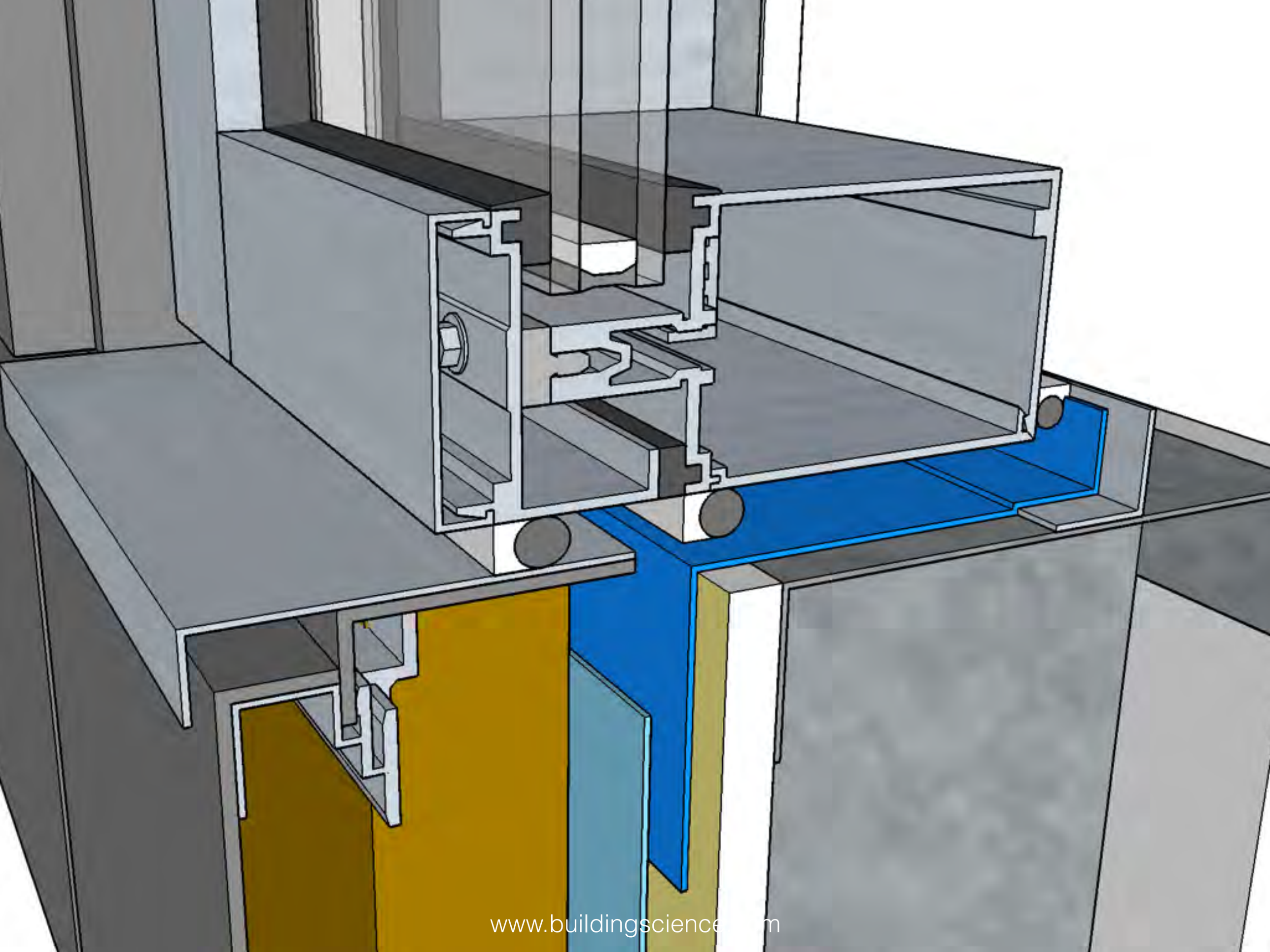
window detailing

- reduce the load (head flashings, overhangs, drips, kerfs)
- integrate control layers
- isolate the window from the wall cavity
- assume imperfection:
  - provide redundancy
  - provide drainage



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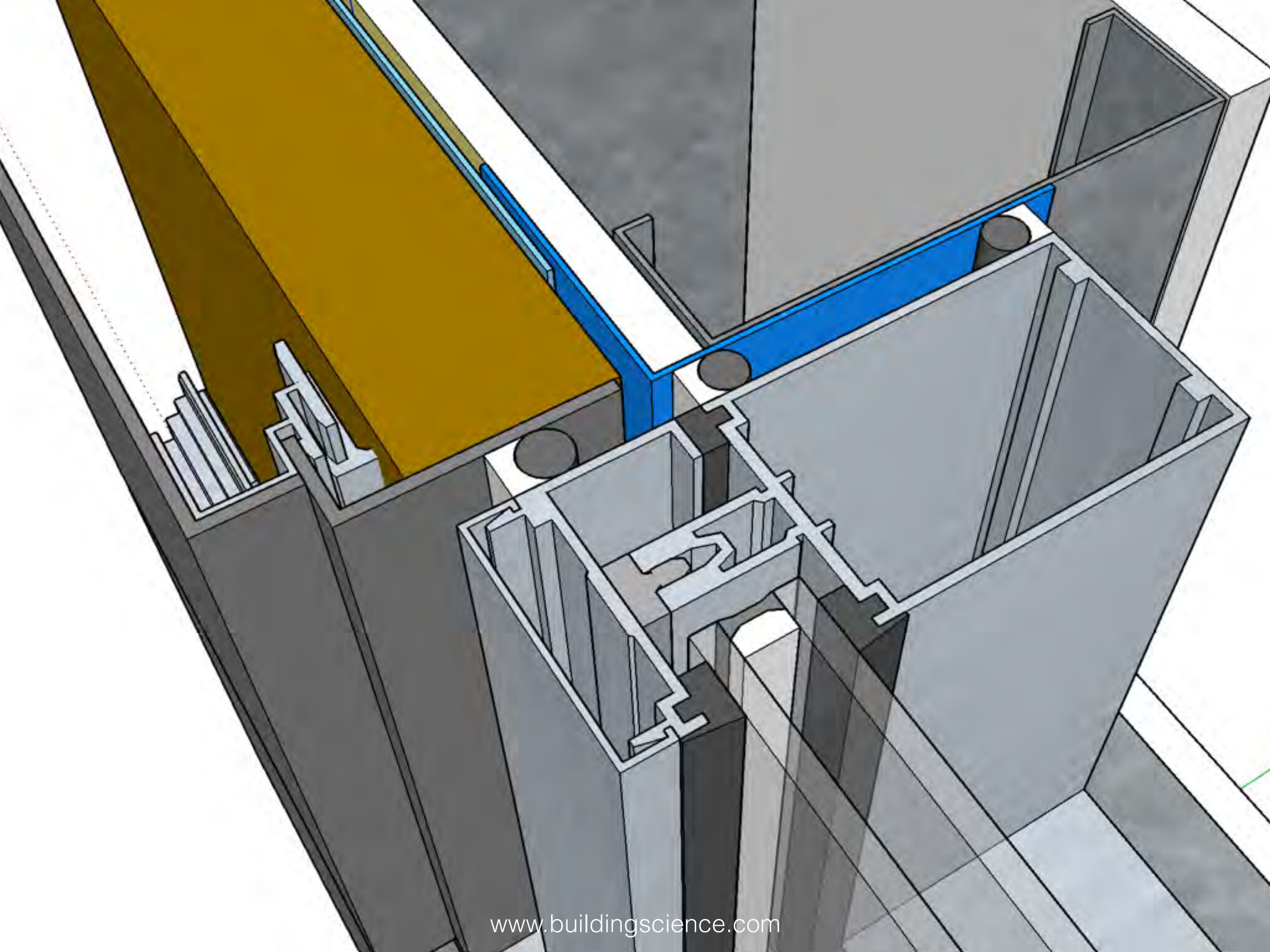

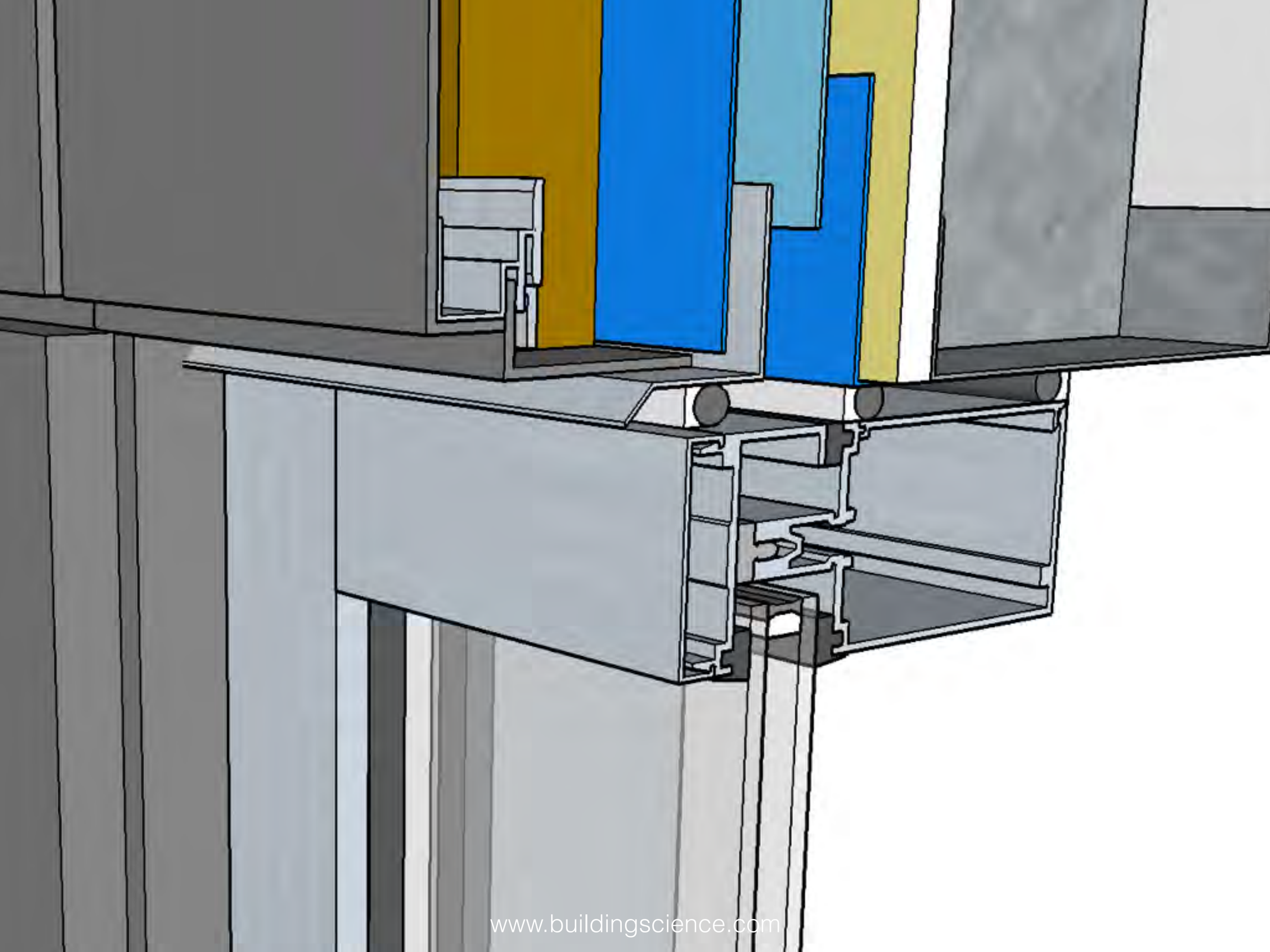

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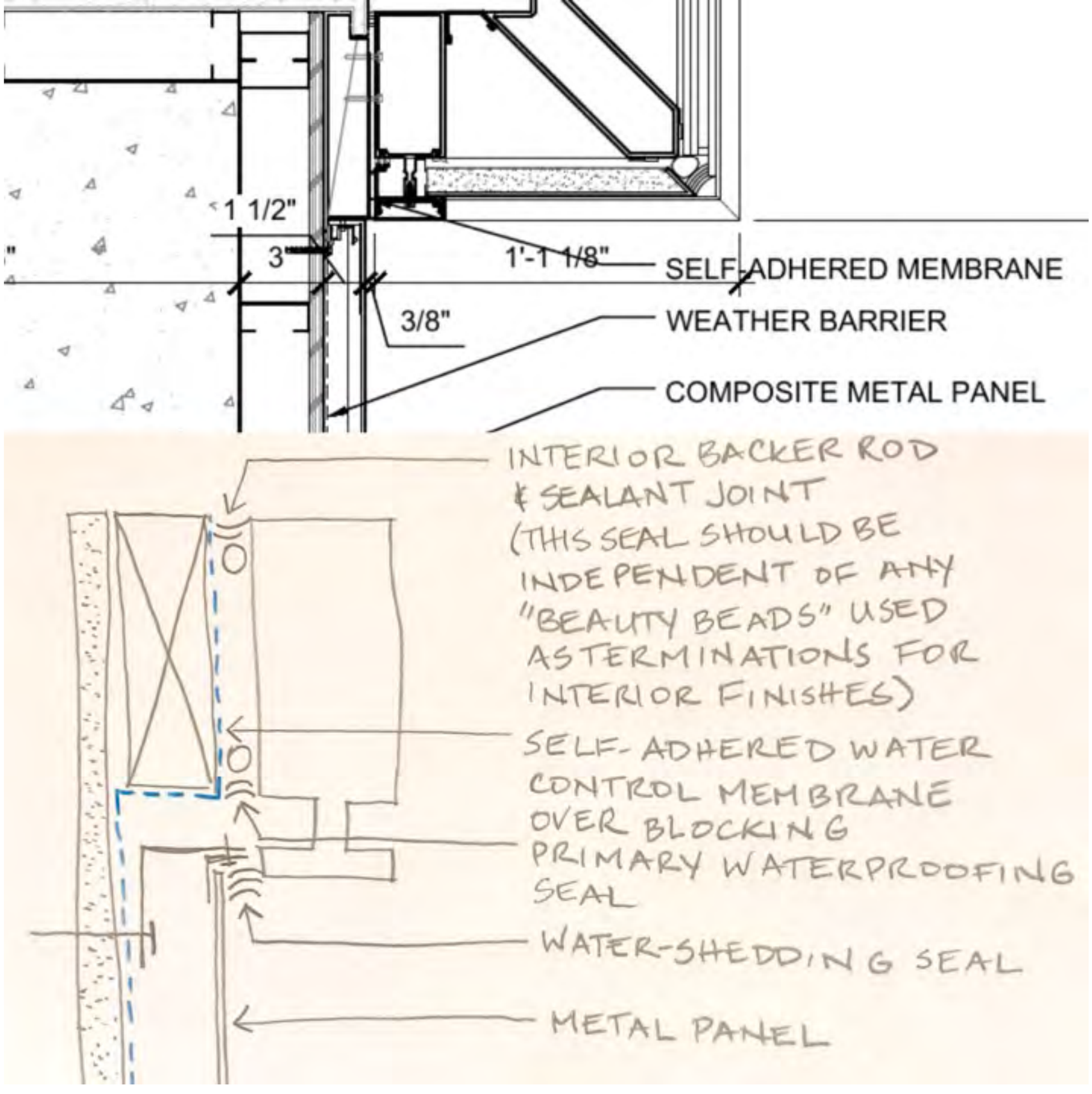
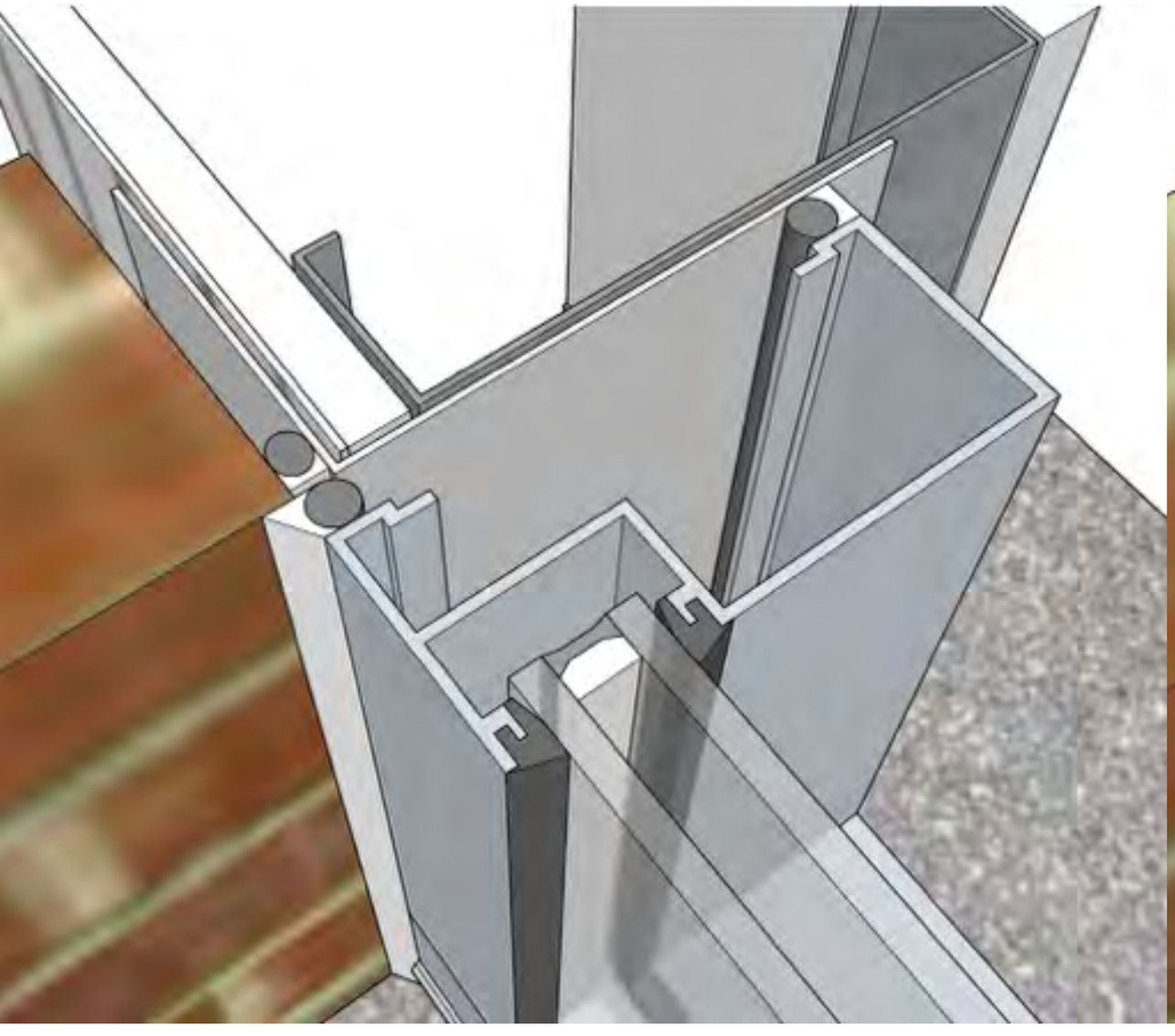
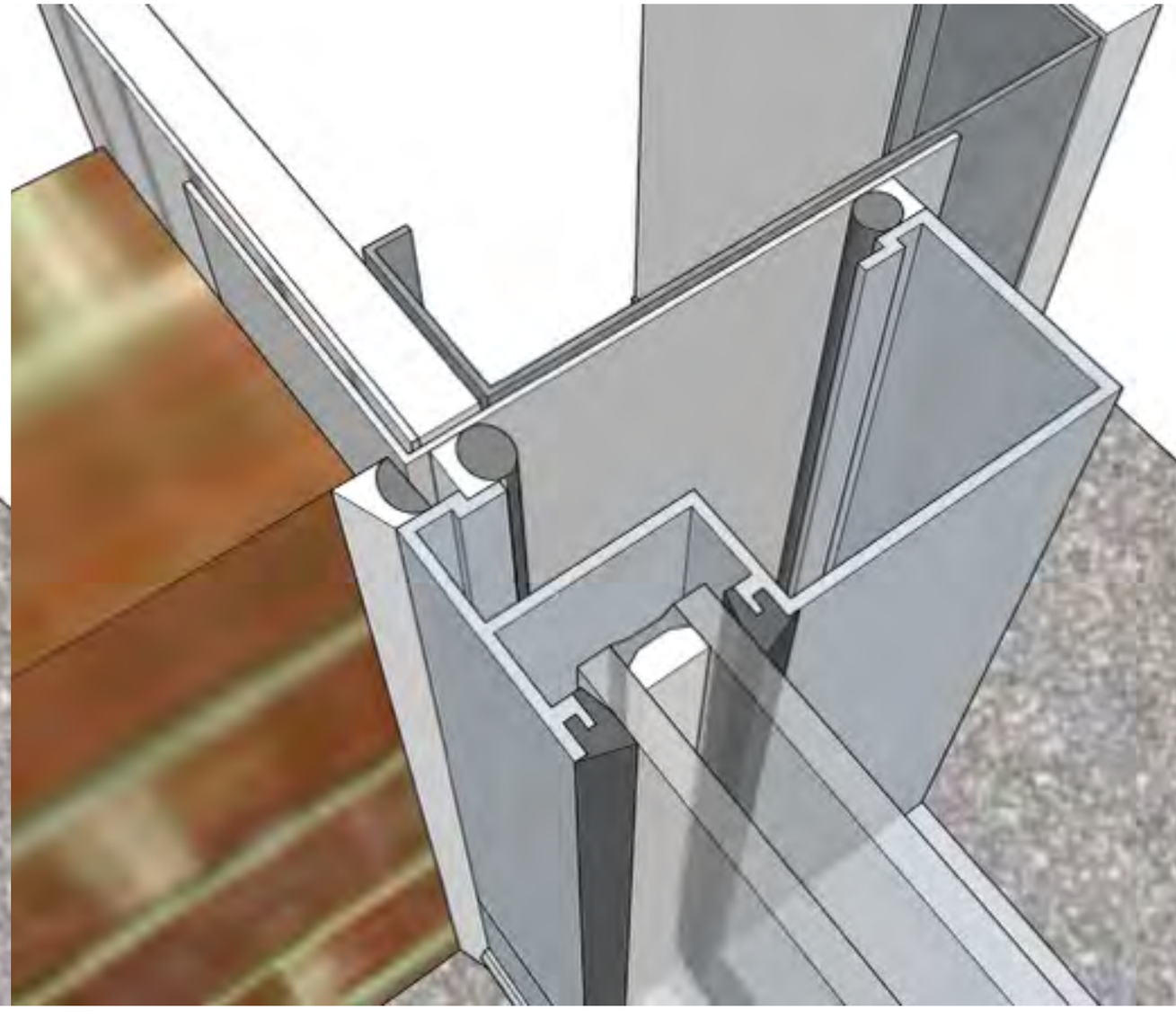

1 1/2"
3"
1'-1 1/8"
3/8"
SELF-ADHERED MEMBRANE
WEATHER BARRIER
COMPOSITE METAL PANEL
INTERIOR BACKER ROD & SEALANT JOINT (THIS SEAL SHOULD BE INDEPENDENT OF ANY "BEAUTY BEADS" USED AS TERMINATIONS FOR INTERIOR FINISHES)
SELF-ADHERED WATER CONTROL MEMBRANE OVER BLOCKING
PRIMARY WATERPROOFING SEAL
WATER-SHEDDING SEAL
METAL PANEL

MMERCIA





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roof system design

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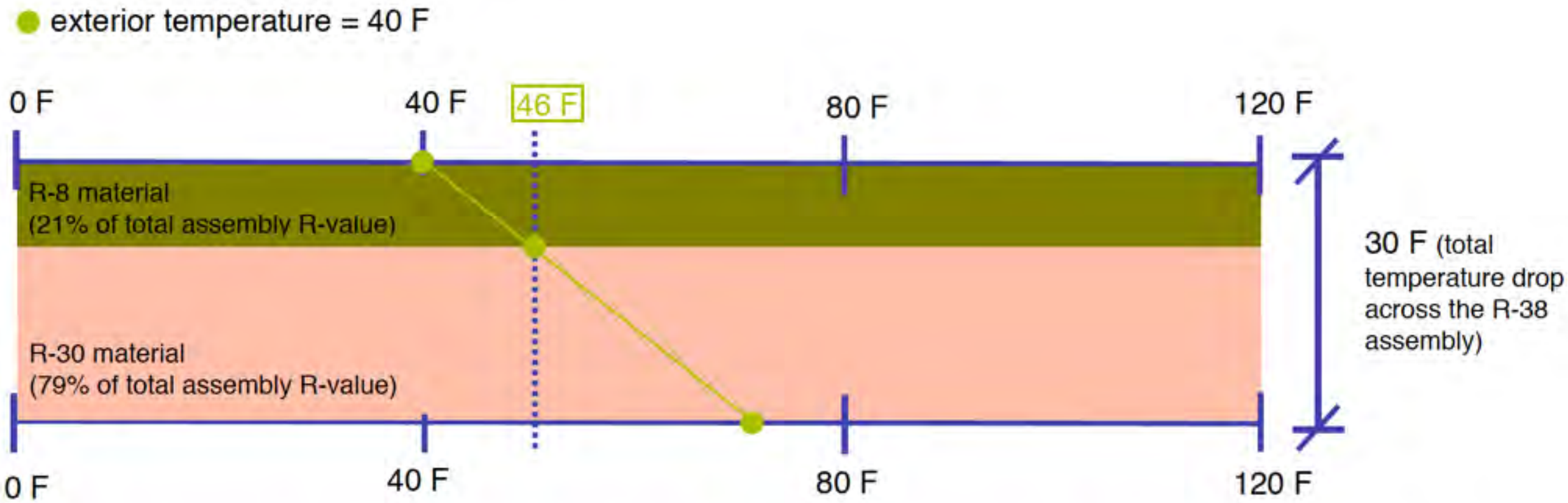
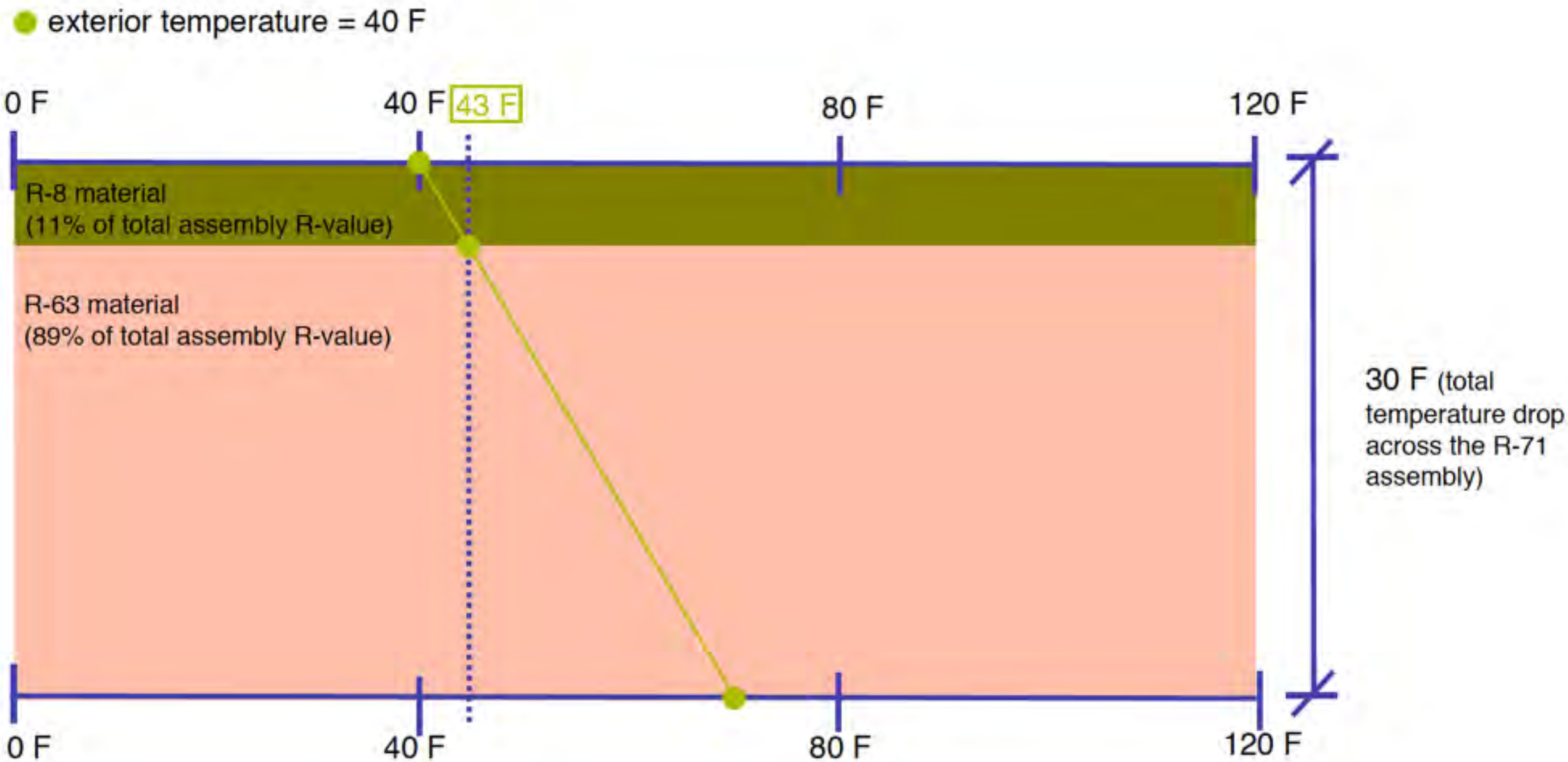
temperature gradient across a roof
comprised of two materials,
each with a different thermal resistance



Since 79% of the total 30F temperature drop occurs across the pink material, the temperature at the exterior surface of the pink material is 46F.
(79% of 30F = 24F ; 70F interior temperature minus 24F = 46F)

temperature gradient across a roof
comprised of two materials,
each with a different thermal resistance



interior temperature = 70 F

Since 89% of the total 30F temperature drop occurs across the pink material, the temperature at the exterior surface of the pink material is 34F. (89% of 30F = 27F ; 70F interior temperature minus 27F = 43F)

Insulation for Condensation Control*

Climate Zone	Rigid Board or Air Impermeable Insulation	Code Required R-Value	Ratio of Rigid Board Insulation or Air Impermeable R-Value to Total Insulation R-Value
1,2,3	R-5	R-38	10%
4C	R-10	R-49	20%
4A, 4B	R-15	R-49	30%
5	R-20	R-49	40%
6	R-25	R-49	50%
7	R-30	R-49	60%
8	R-35	R-49	70%

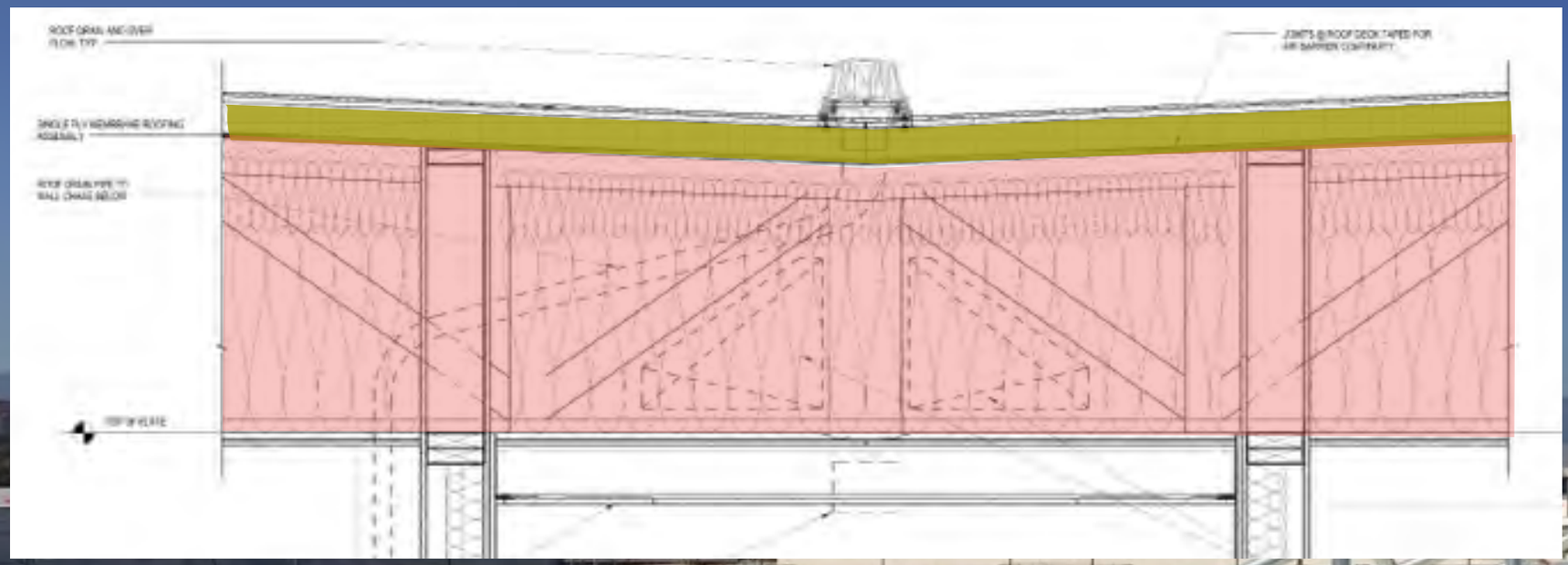
*Adapted from Table R 806.5 2015 International Residential Code

5.1.4. Alternatively, sufficient rigid board or sheet insulation shall be installed directly above the structural roof sheathing to maintain the monthly average temperature of the underside of the structural roof sheathing above 45°F (7°C). For calculation purposes, an interior air temperature of 68°F (20°C) is assumed and the exterior air temperature is assumed to be the monthly average outside air temperature of the three coldest months.

These ratios are based on tables from the residential code. The commercial code requires different (typically lower) total R-values for roof assemblies. Use the ratios shown here for your calculation, even for commercial applications. Or calculate what's required based on the 45 degree rule in Section 1203.3.5.1.4.
You may wish to increase the ratio to account for higher interior humidity on your project.

Read: Building Science Insight 100: Hybrid Assemblies
https://buildingscience.com/documents/building-science-insights/bsi-100-hybrid-assemblies

for example…



36-inch truss, completely filled with insulation (per fire code)
36 inches fiberglass batt insulation @ R-3.5/inch = R-126

For condensation control ~10 -15% comprised of air impermeable insulation OR located on top of roof deck:

Option A: replace 5 inches of fiberglass batt insulation with open cell SPF
Option B: Add 5 inches rigid insulation on top of the deck… for total of ~R-150

So what does an R-150 roof look like?