Building Enclosure Detailing for Balconies

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

Outline

- Building science basics
  - Control layers (water, air, heat)
  - The 4 D's (deflection, drainage, drying, durability)
- Case studies
  - How and where bad stuff happens
  - How to do the tricky stuff right
- Code overview and what's next
- A better way forward

Building Science Basics

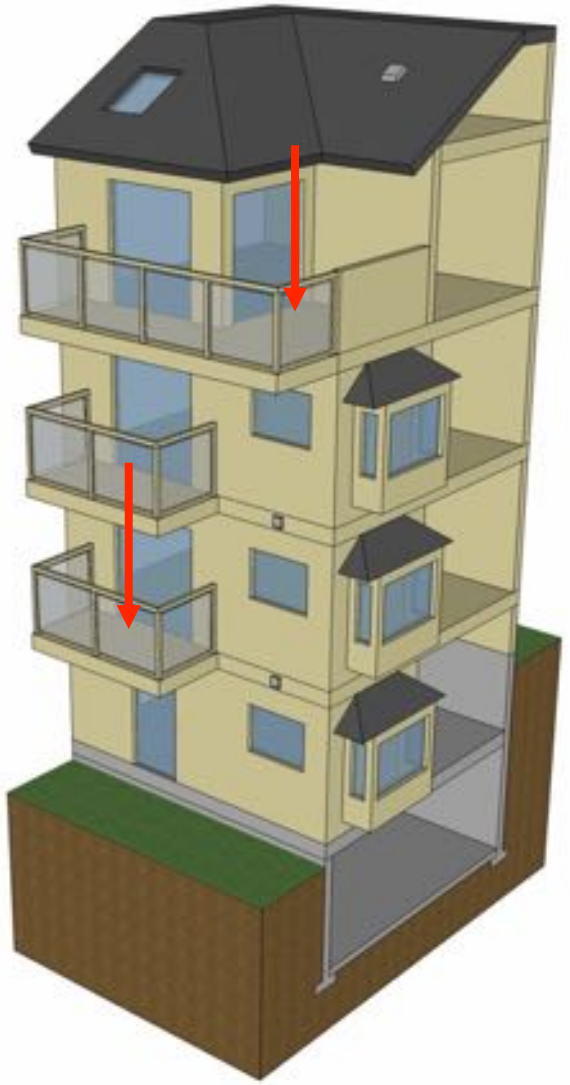
→ Water control

→ Air control

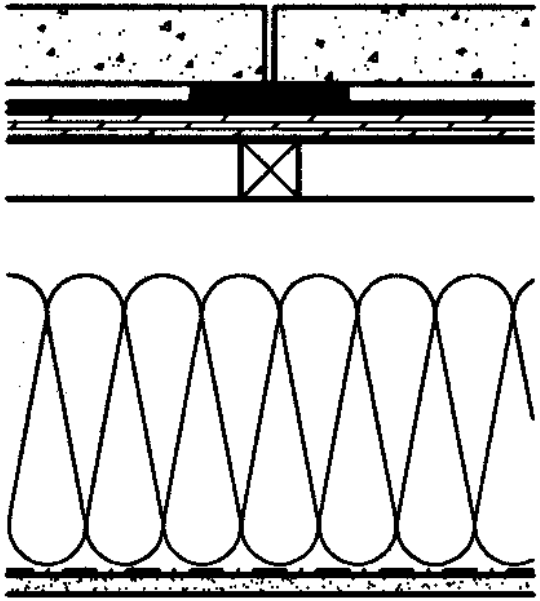
→ Heat control

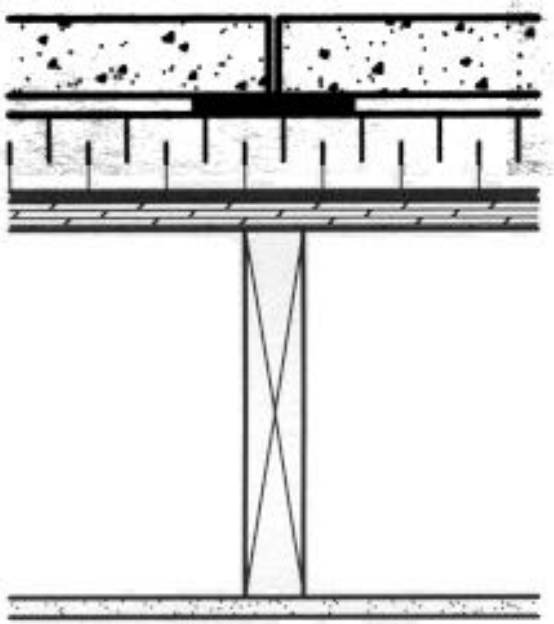
Roof, Deck, or Balcony?

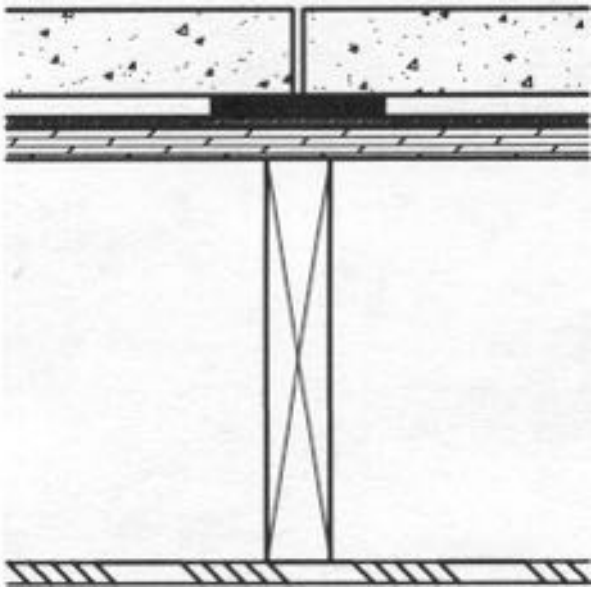
- → Roof
  - → Separates interior and exterior space
  - → The top of a building
- → Deck
  - → A roof that you also walk on
- → Balcony
  - → Outside building's heated perimeter
  - → A protection beyond the face of the building enclosure

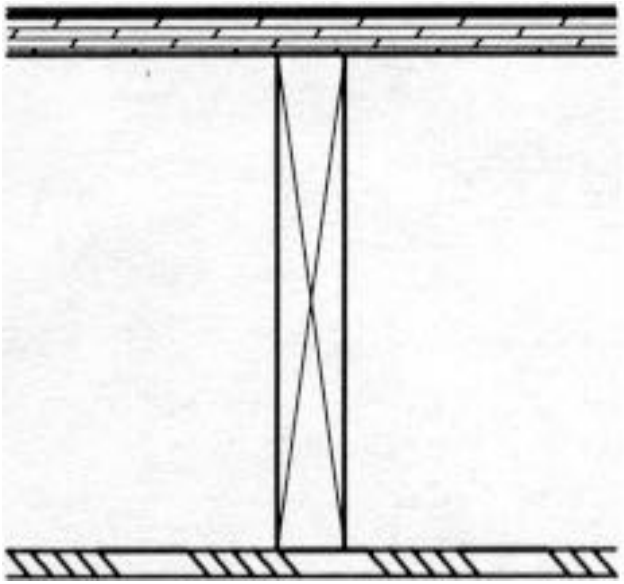


Deck or Balcony?



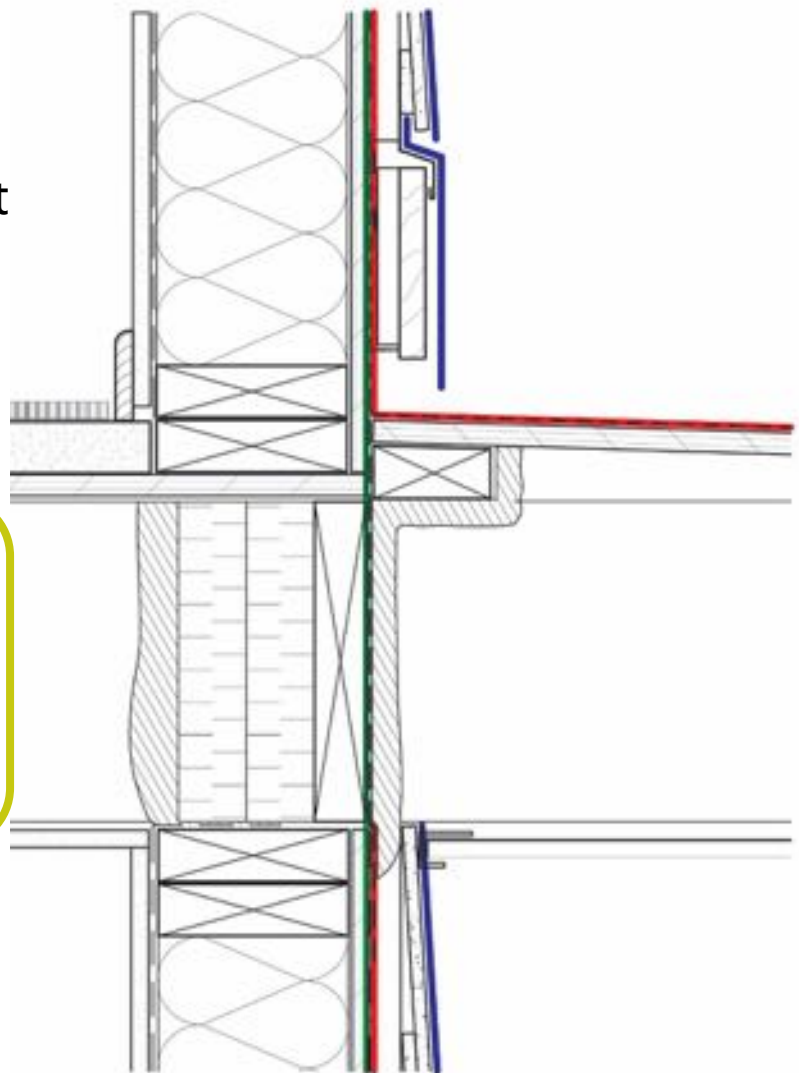






Building Enclosure Functions

- → Support:
  - → Loads – structural and environment
- → Finish:
  - → Look good?
- → Control:
  - → Heat flow – thermal barrier
  - → Air flow – air barrier
  - → Vapor diffusion – vapor barrier
  - → Water penetration – water barrier
  - → Light and solar radiation
  - → Noise, fire, and smoke



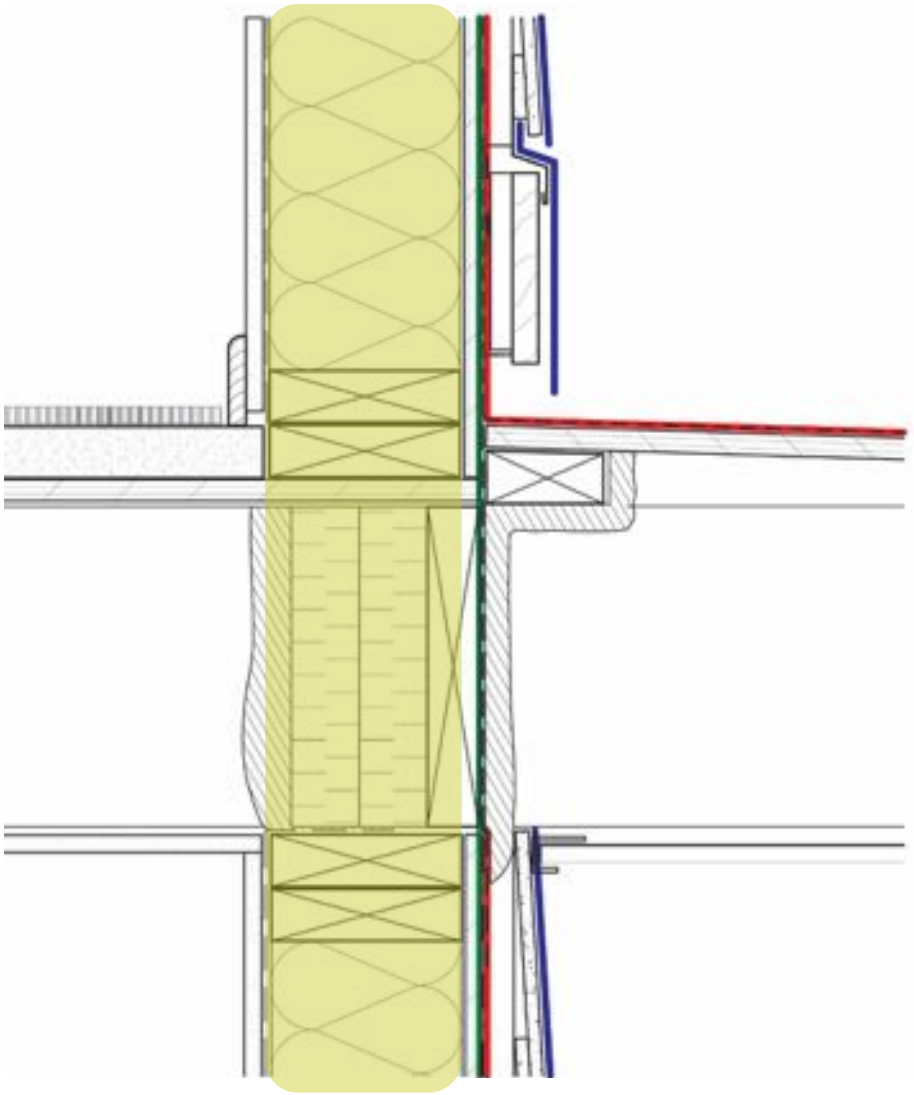
- → All of these apply to balconies too!

Continuity of Control Layers

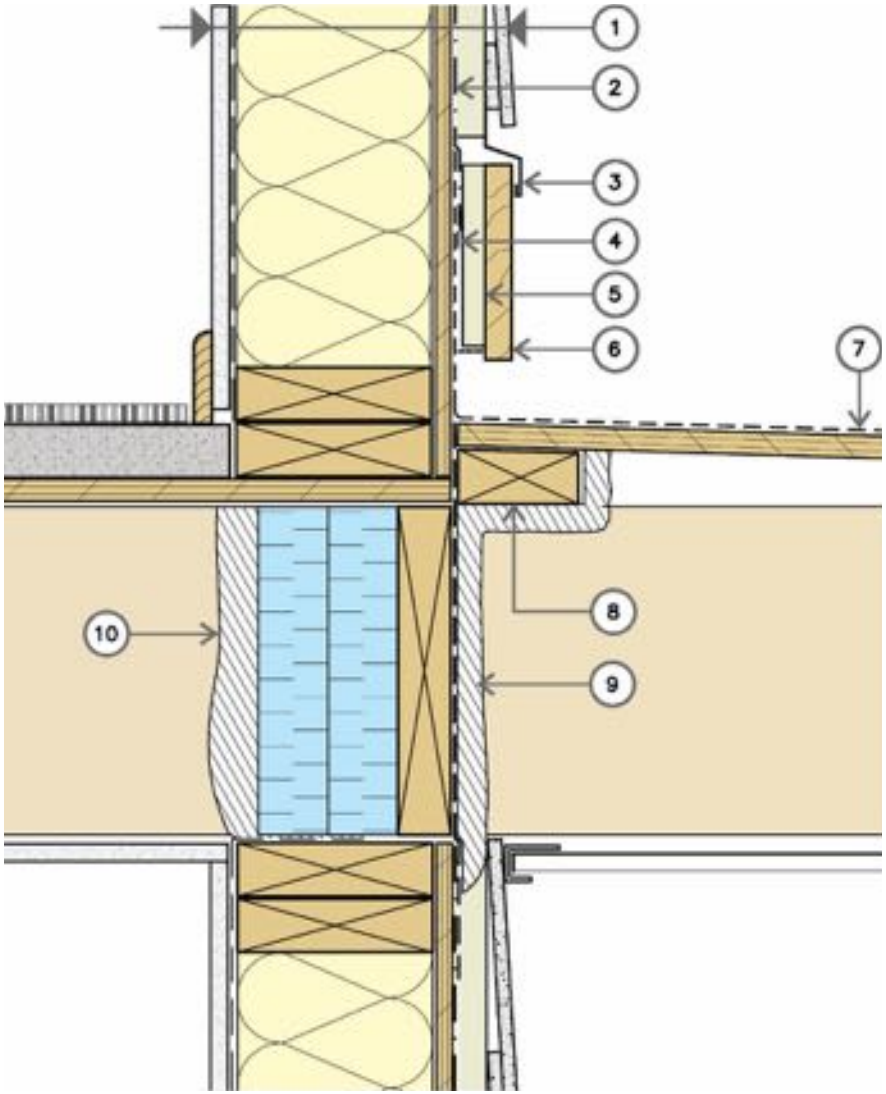
- → Balconies typically project through the vertical wall and interrupt the control layers
- → What happens to the control layers at the interface?
  - → Where is the air barrier?
  - → Thermal barrier?
  - → Water barrier?
  - → Vapor barrier?

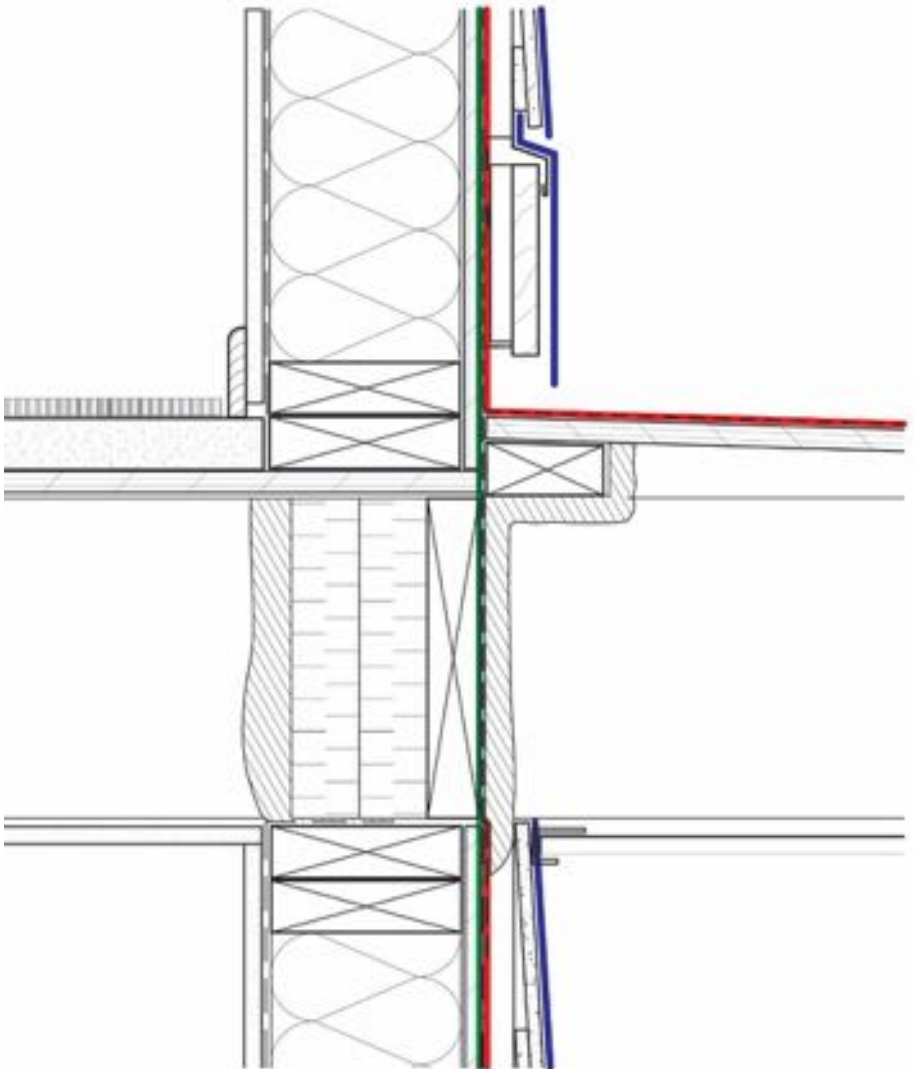
Continuity of Control Layers

- How to design a detail:
  - Identify the 4 control layers within each assembly
  - Connect each of the layers across the detail
  - Do not lift your pencil off the page
  - Select appropriate materials to make the necessary transitions
    - There isn't a 'right' way here



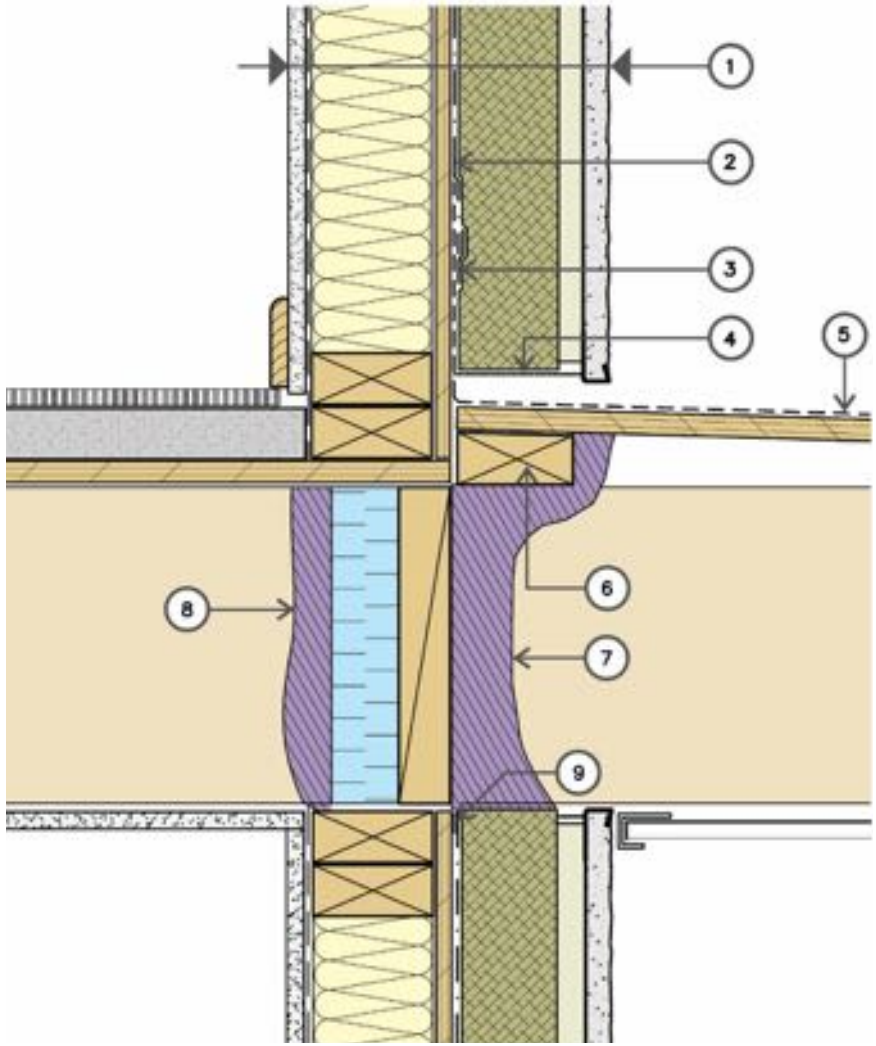
Cantilevered Balcony – Control Layers





Continuity of Air / Thermal Control Layers

- → Air barrier and thermal barrier continuity often overlooked
- → Difficult to reliably detail sheet membrane around penetrating joists
- → Spray foam often used for air and thermal control



Continuity of Air / Thermal Control Layers

The 4 D's of Water Penetration Control

- Deflection
  - Minimize the amount of exposure to bulk water - overhangs, drip edges, crickets
    - If it doesn't get wet, it can't leak
- Drainage
  - Slope and drain all areas that are to the exterior of the water control layer
- Drying
  - Wetting is OK if it dries before it causes a problem
  - Balcony and parapet walls – limited drying
  - Venting helps – if the air is dry
- Durability
  - Use materials that can get wet

Case Studies

→ Lessons learned

Water Enters at Details!

- → The field of the membrane, or the selection of the membrane, is rarely the culprit
- → Membrane durability is important for longevity and durability, but most premature failures have little to do with membrane selection
- → Continuity of water control layer at interfaces and details
- → 2D details do not adequately depict the 3D interfaces

Water Enters At Details

#1 – Metal Flashings / Copings

→ Difficult to make metal flashing watertight

→ Include membrane below and provision for drainage

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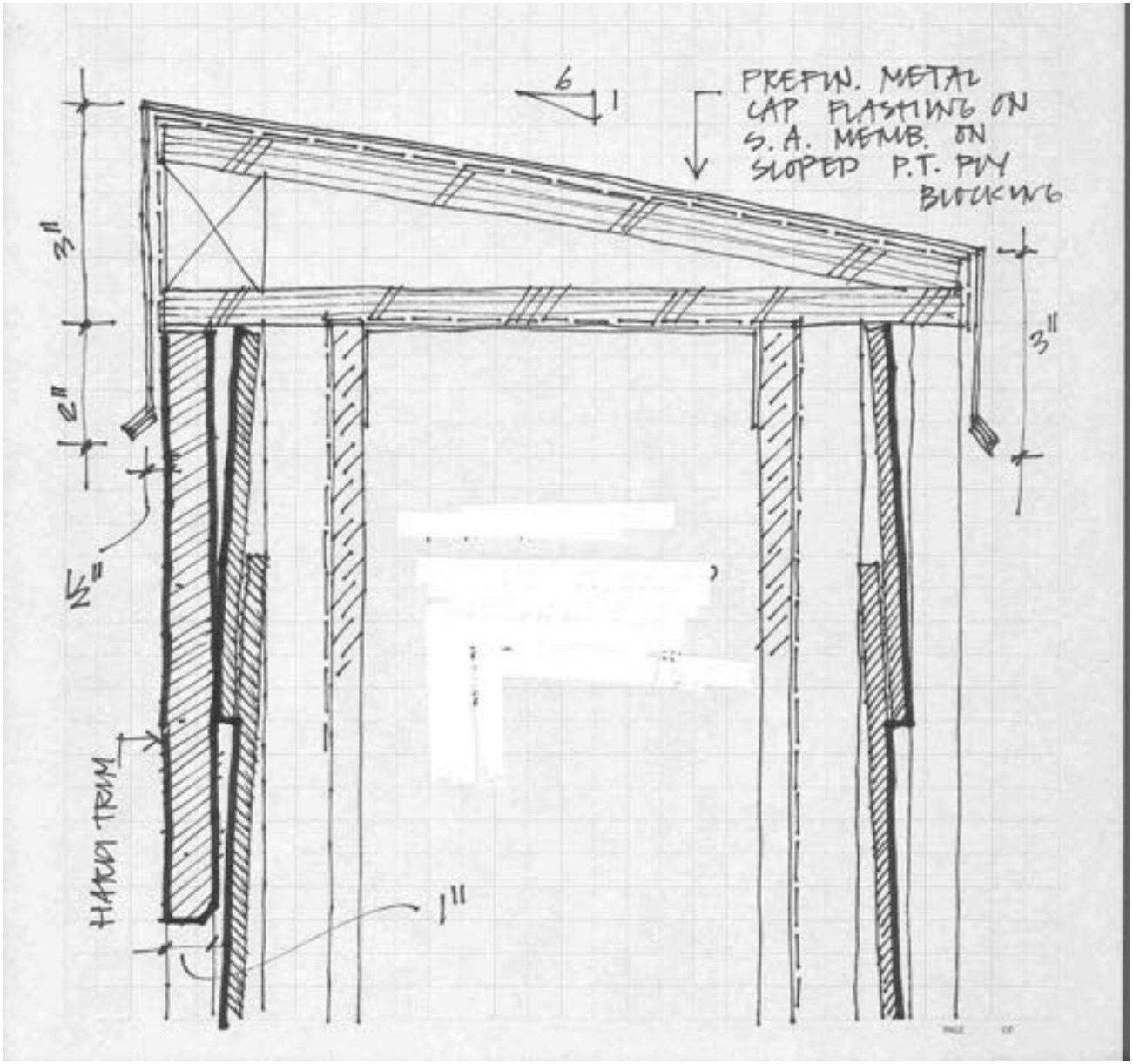

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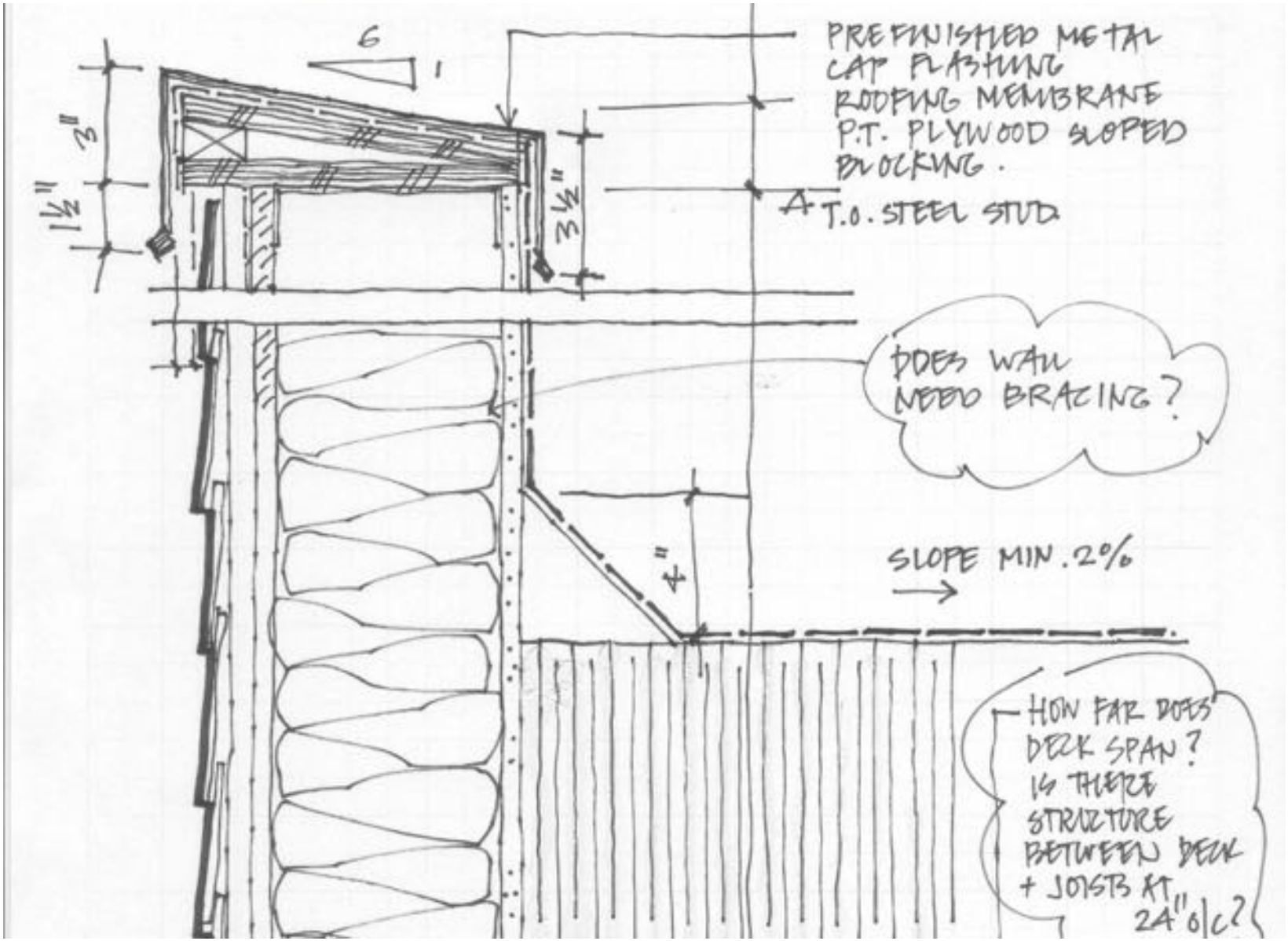
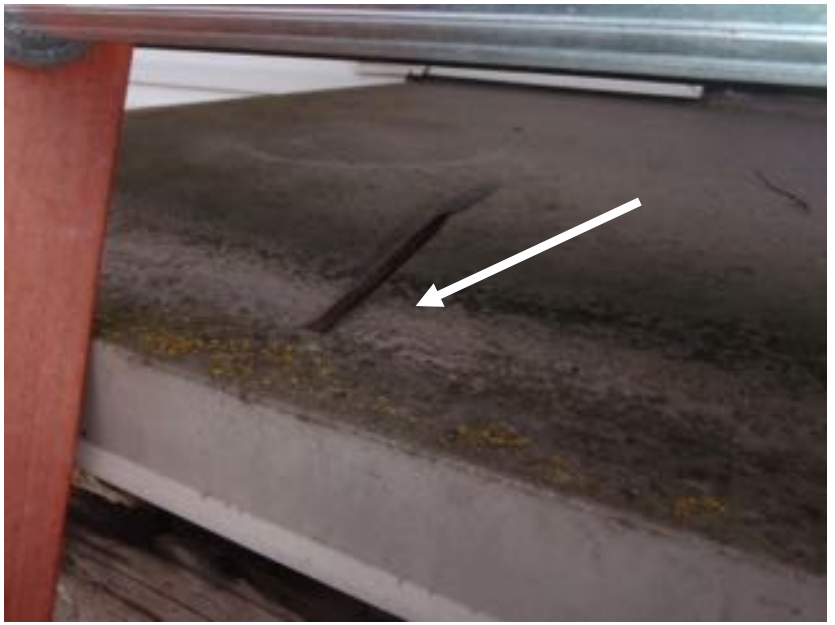


Drip Edges Matter

#2 – Membrane durability & maintenance

- → Liquid applied traffic coatings can work well… or poorly
- → Adequate thickness and reinforcement at joints in substrate critical
  - → Plywood seams
  - → Flashing transitions
- → Maintenance required



#2 – Membrane durability & maintenance

#3 – Overlooked Fascias

- → Fascias need to be treated like walls
  - → WRB
  - → Drainage between cladding and WRB
  - → Use rainscreen approach
- → More exposed to water than most wall areas
- → No ‘free’ drying from heat loss from interior space

#4 - Guardwalls (Parapets)

- → Parapets often badly damaged
  - → Higher exposure
  - → Limited drying (no heat flow)
- → Details:
  - → Tops
  - → Guardwall to deck
  - → Guardwall to wall
  - → Through-wall scuppers
- → Repair:
  - → Replace walls with rails
  - → Fix the remaining details

#4 – Guardwalls (Parapets)

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#5 – Bad Drainage / Concrete Topping Slab

- → Concealed membrane with concrete topping slab
- → Edge draining design but limited ability for water to drain at w.p. level
- → Unvented soffits
- → Repair:
  - → Remove and replace topping slab, membrane, and all transition details
  - → Reframe with new cantilevered joists 3 ft. into interior of bldg.

#5 – Concrete Topping Slab

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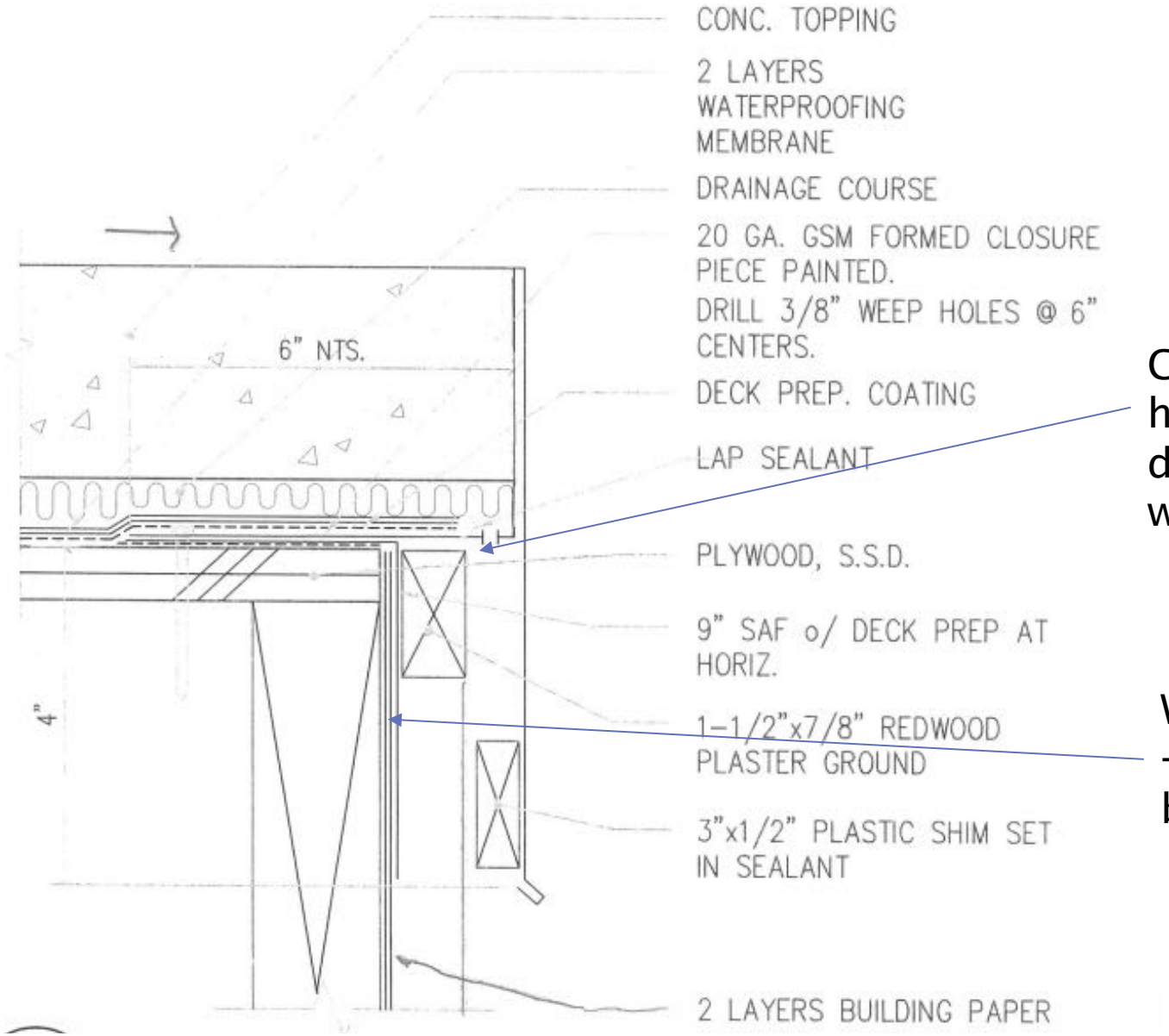

Critical to have good drainage at w.p. level!

Water barrier + drainage behind fascia

#6 – Structural Concrete Balconies

- → Concrete balconies are not immune to deterioration
- → Numerous repairs required to exposed concrete buildings
- → Carbonation of reinforcing steel, freeze-thaw damage
- → Rebar corrosion, spalling
- → Often replaced with precast or steel

#6 – Structural Concrete Balconies

#7 – Non-Durable Materials

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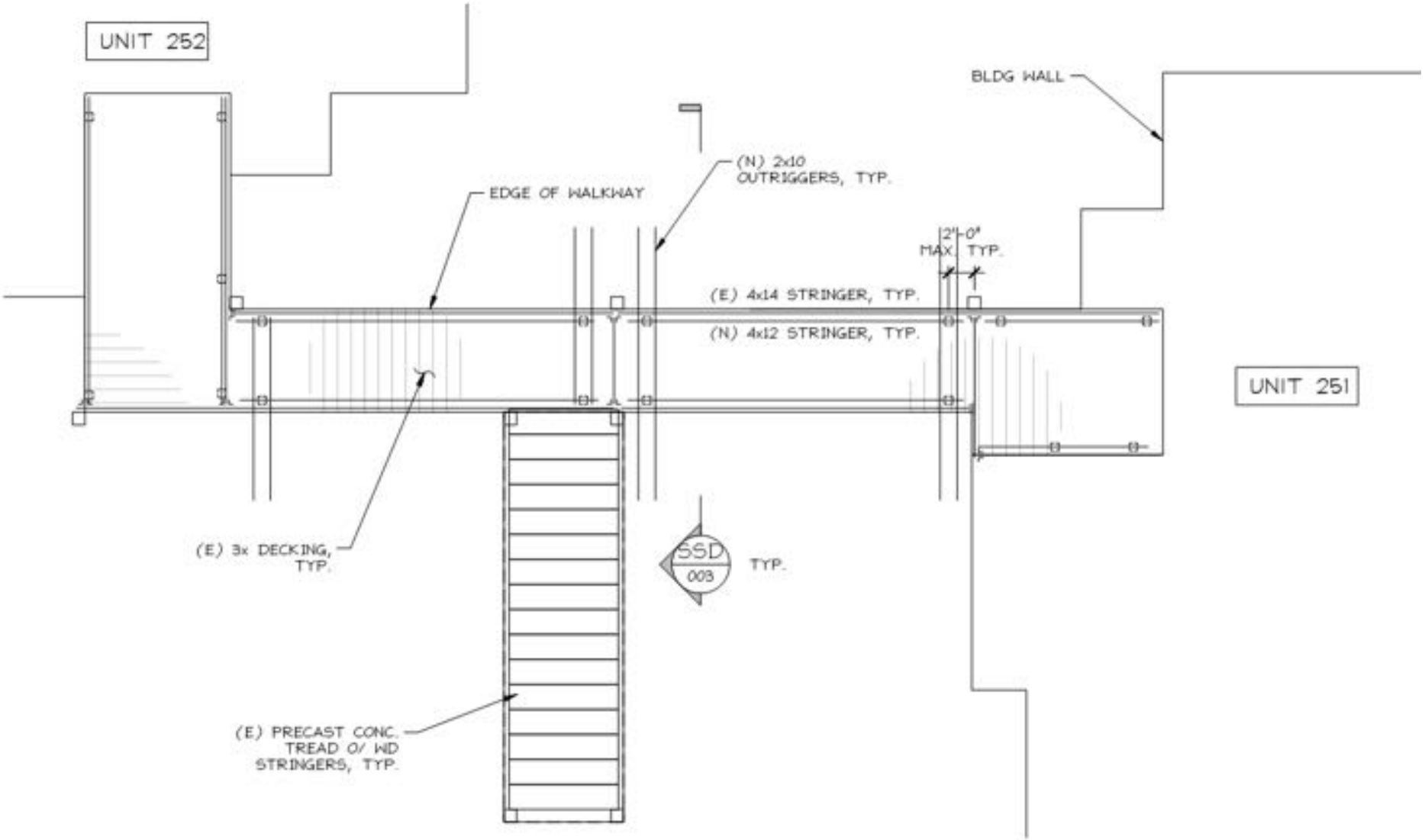
#7 – Emergency Shoring



Emergency Shoring

#8 – Exhaust Vents

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How to Make Balconies Work

Cantilevered Balcony - Saddles

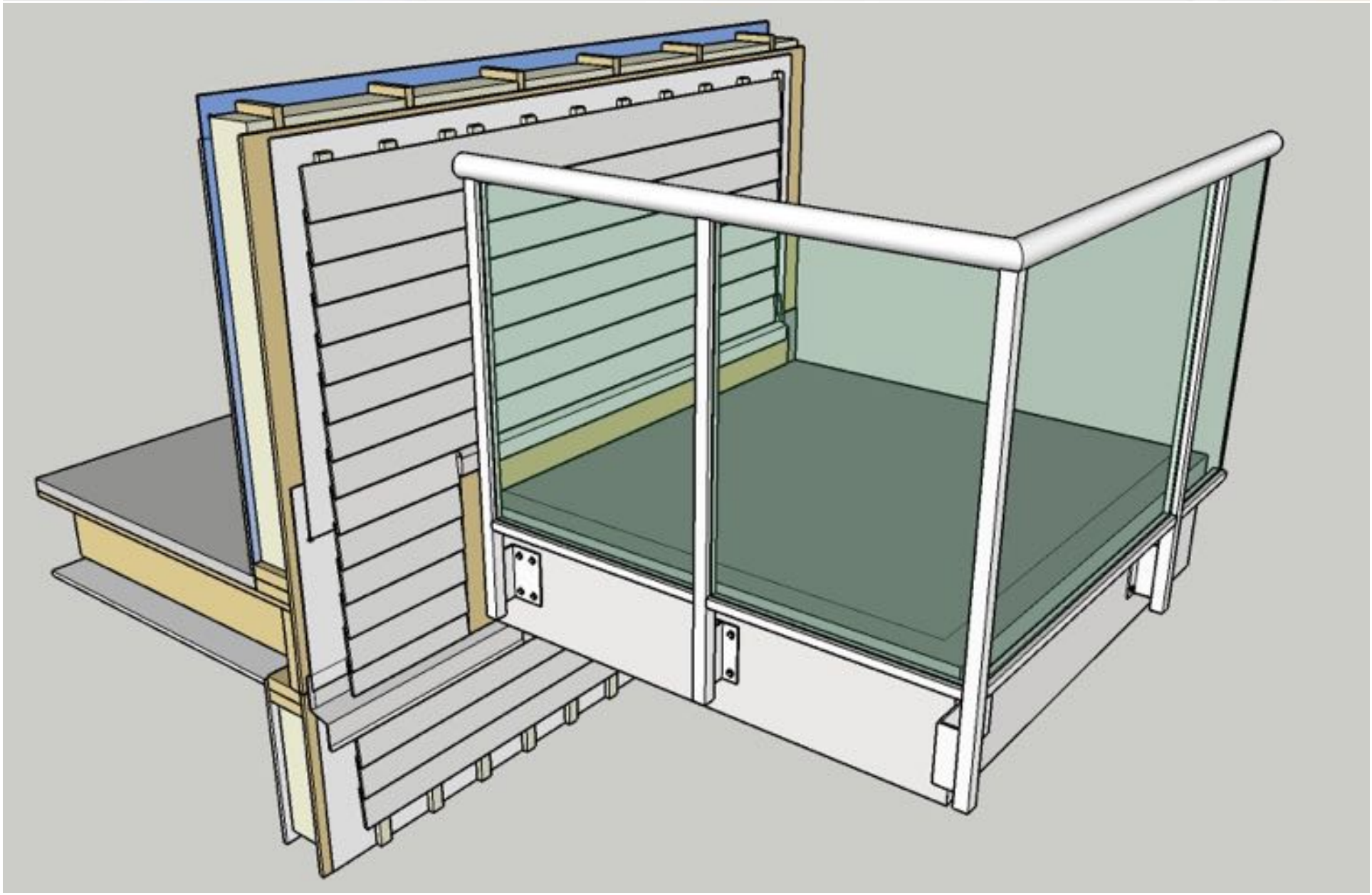
Can you spot them?

Cantilevered Balcony - Saddles

→ 3-dimensional integration of assemblies

→ Include a 3-dimensional detail

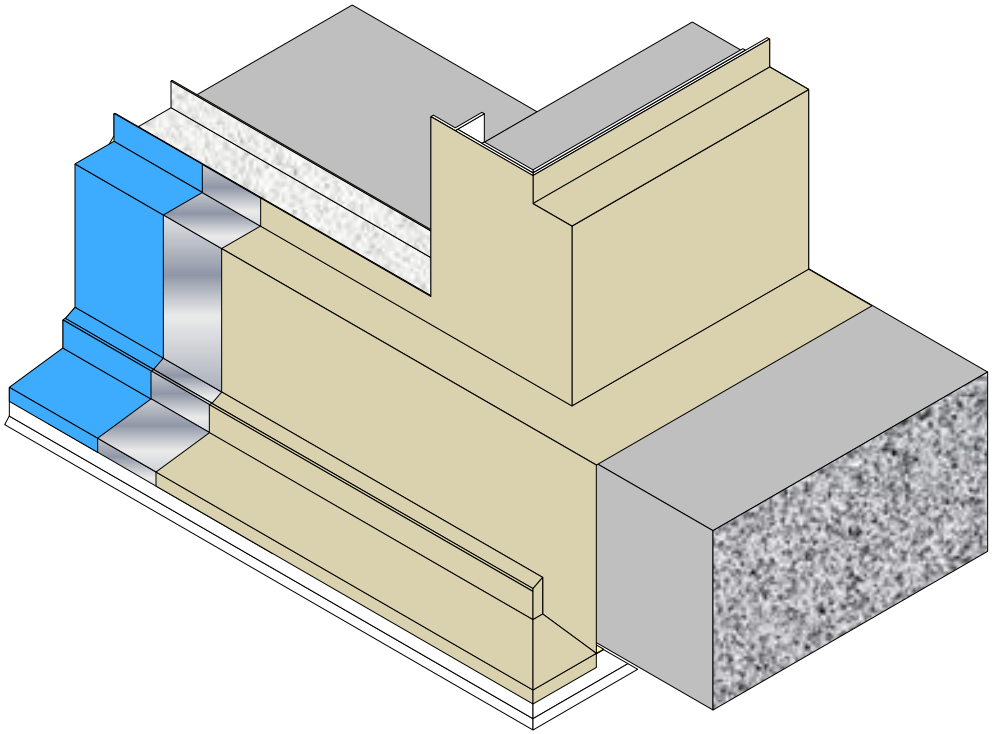
Continuity of Water Control Layer



Balcony Corner – Wood Frame

Balcony/Deck Edge – Concrete Frame

Balcony/Deck Edge – Concrete Frame



Balcony curb wall at slab edge

Window deflection head

Steel stud track

Metal sill angle

Rod and caulk backing for membrane

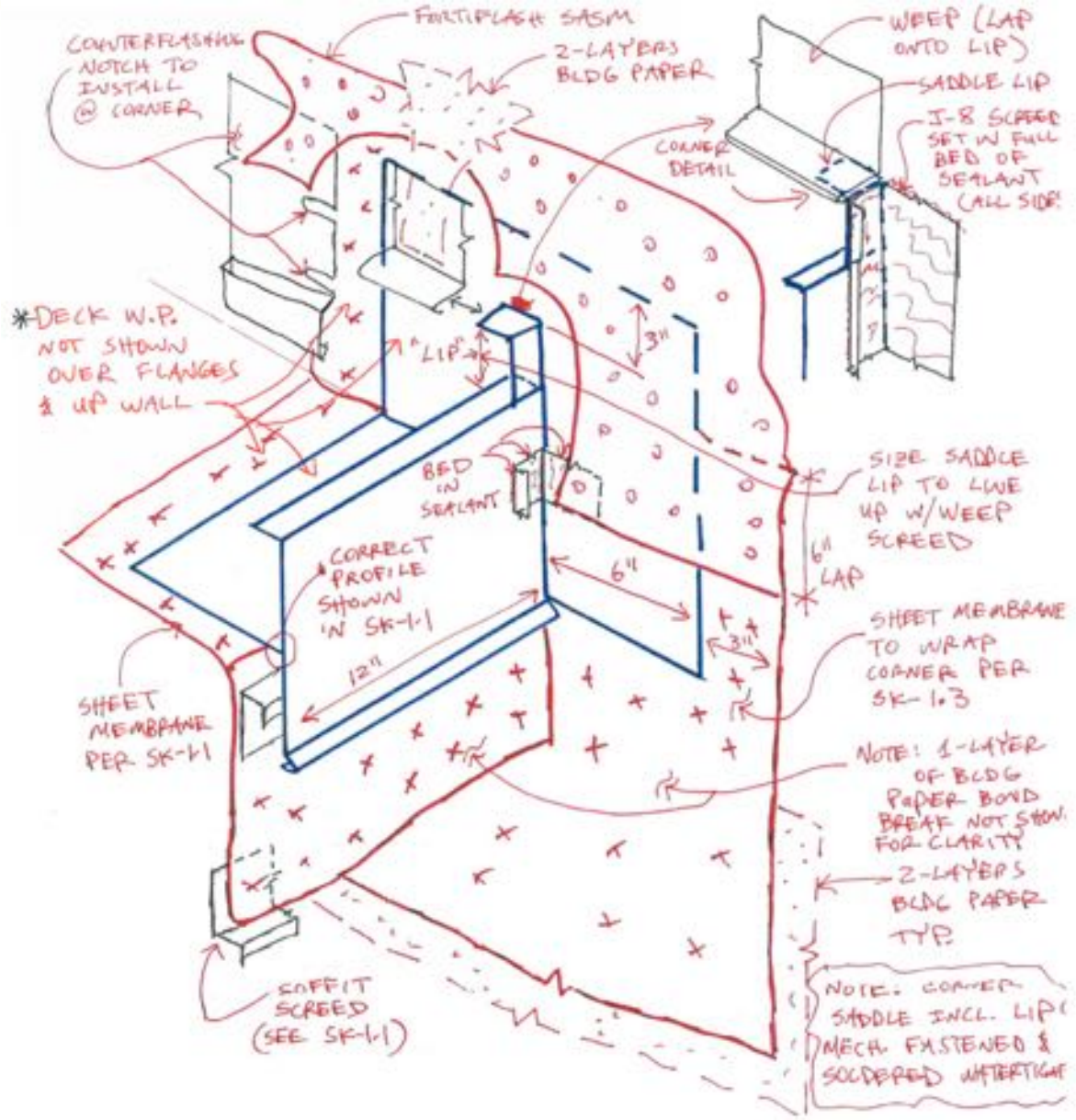
Seal stud track to slab

Foil Face peel-and-stick membrane

Standard peel-and-stick membrane

Fully reinforced liquid membrane

Balcony Corner Saddle Flashing

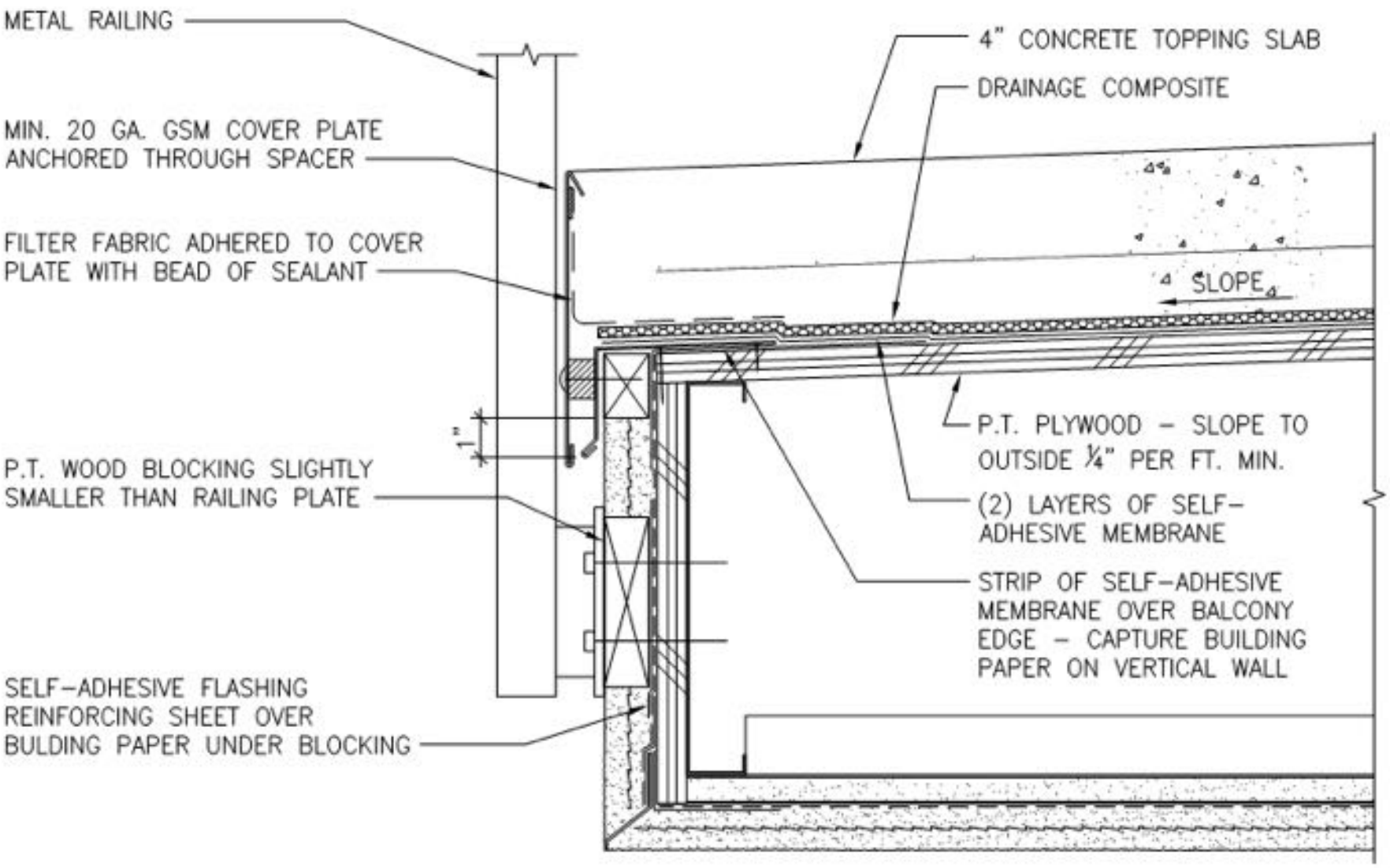


Balcony Corner Saddle Flashing

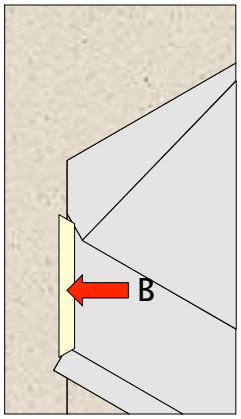
Balcony Corner Saddle Flashing

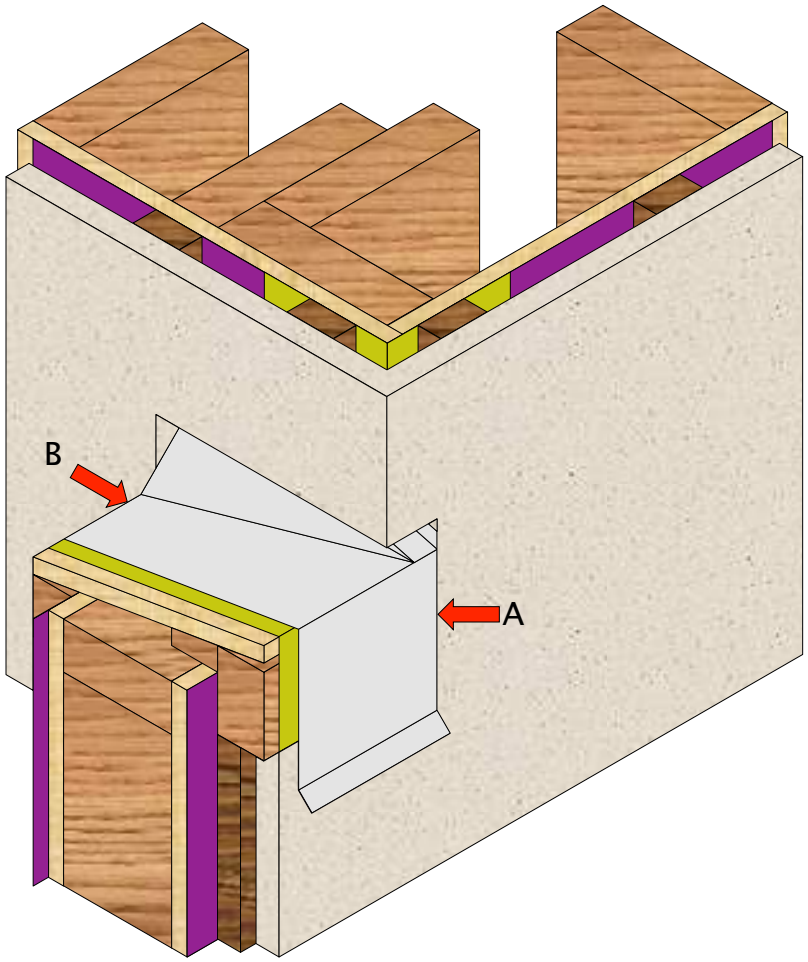
Balcony Corner Saddle Flashing

Balcony Edge Flashing – Concrete Topping

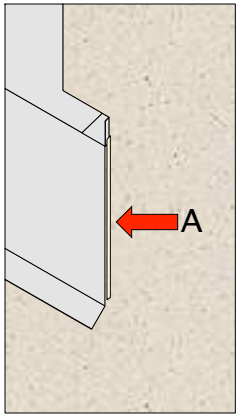


Guardwall Flashing Details





Framing
Wall Sheathing
Sheathing Paper
P.T. Wood Sloped Blocking
Sloped Blocking Membrane Flashing
Wall Membrane Flashing
Sheathing Paper
Corner Membrane Flashing
P.T. Wood Strapping
Metal Parapet Flashing
Stucco Cladding
Exterior Caulking



Parapet to Wall Flashing

Building Codes

- What's coming next?

Venting and Inspection

- → CBC only technically requires venting of “attics” or enclosed rafter spaces with “ceilings” and “insulation”
- → Berkeley added for multi-family:
  - → “Ventilation of Weather Exposed Enclosed Assemblies”
  - → Access panels required to be able to inspect framing
  - → Or removable soffit cladding
  - → Or “Removable soffit vents 4 inch min. in width” which provide both venting and inspection requirements
  - → Mandatory inspections every 3 years (and all balconies within 6 months)
  - → “naturally durable wood, preservative-treated wood, corrosion resistant steel or similar…”
- → San Francisco since 2003 has required inspections every 5 years (includes decks, landings, stairs, metal decks….)

Water Testing?

Design Review, Field Review, Maintainance?

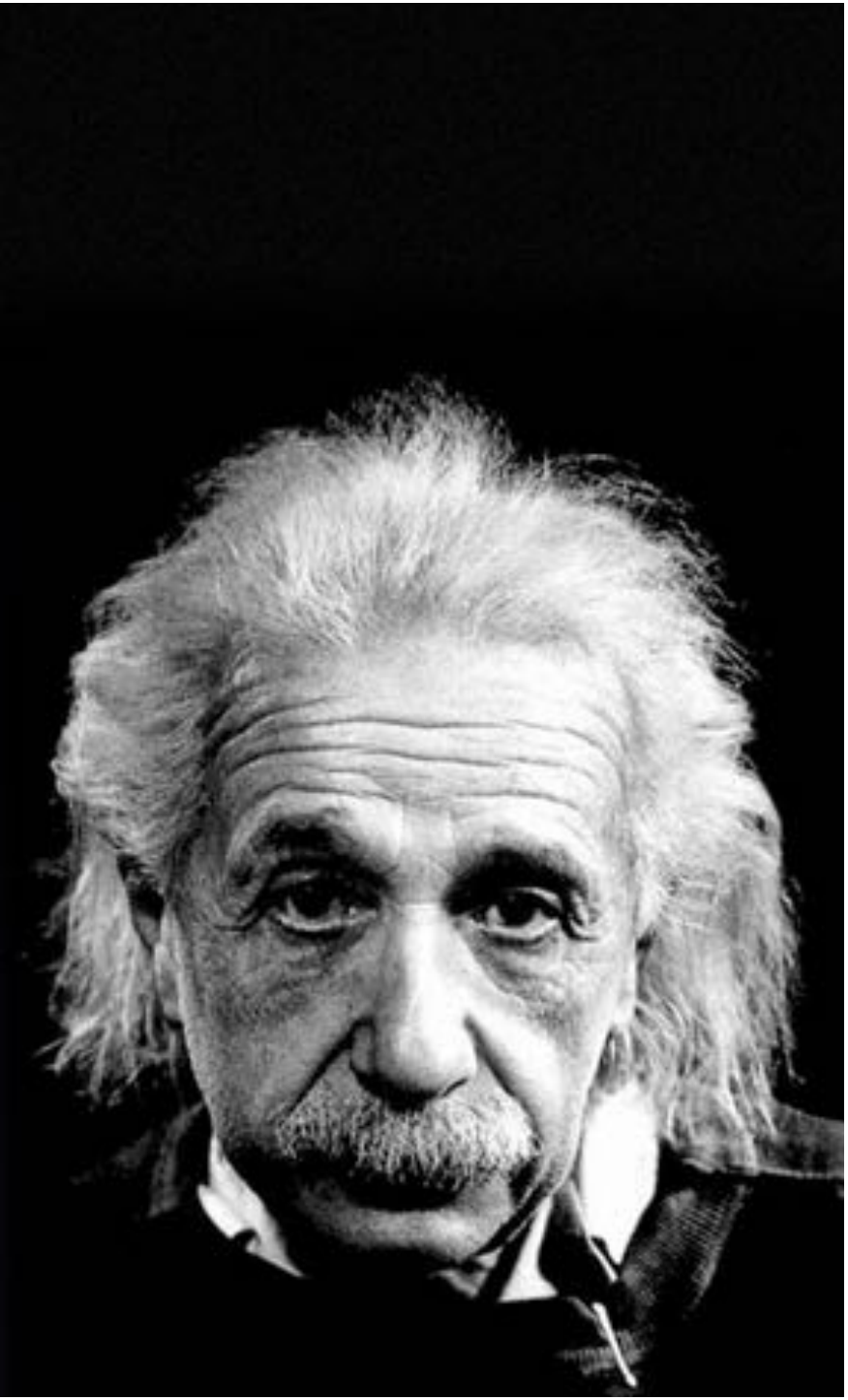
- → Washington State requires all new multi-family residential to have the building enclosures "certified by a qualified party" – typically by a 3rd Party building enclosure consulting firm
- → Oregon State requires all new condos to have a 30-year reserve study and building maintenance plan so that the future owners understand the long term capital needs
- → City of Palo Alto requires "special inspections for waterproofing on certain projects"
- → Alternate non-cantilevered balcony designs?

A Better Way?

- Avoid the hard details altogether

“Everything should be made as simple as possible, but not simpler.”

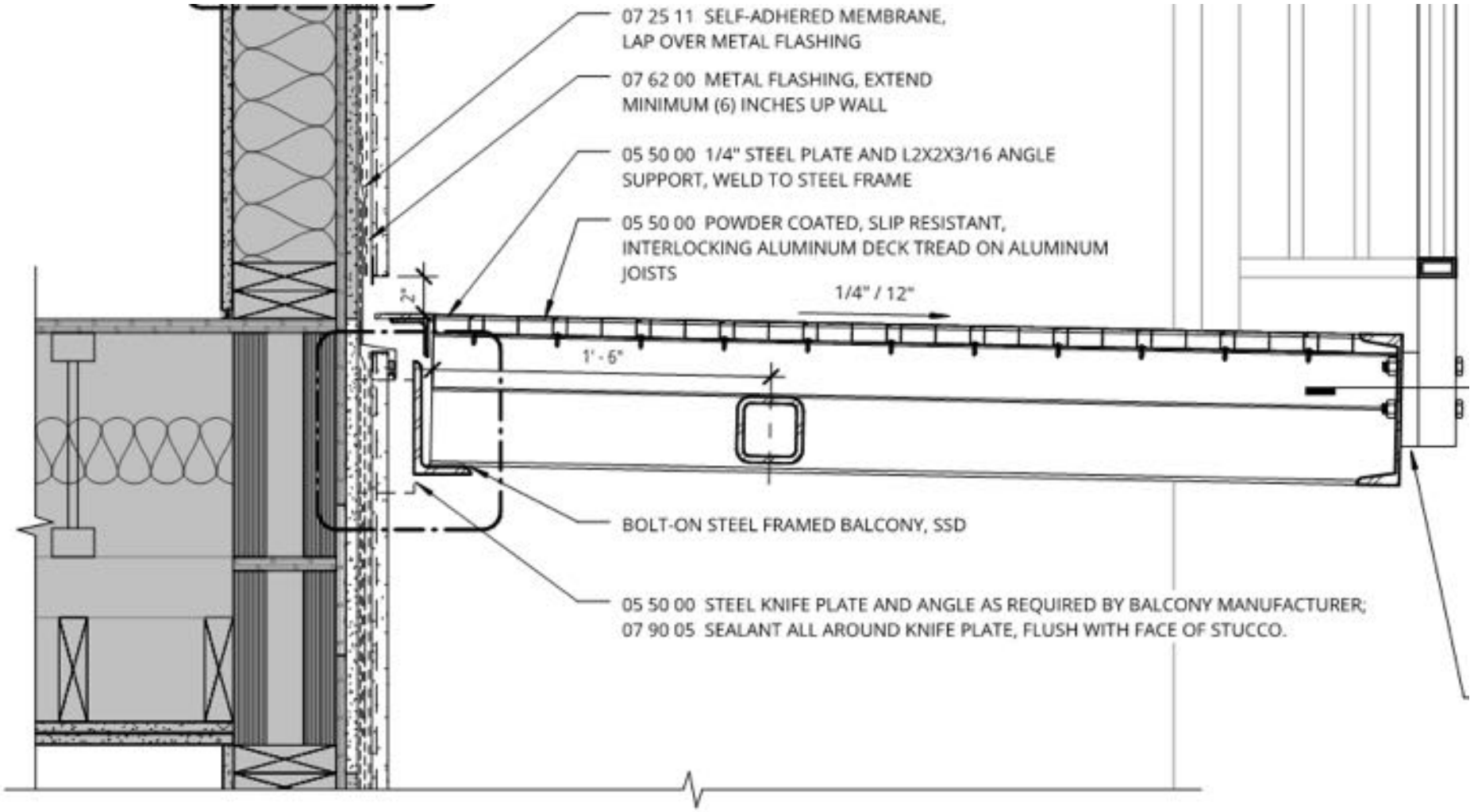
Albert Einstein



Pre-Finished Balcony

- → Balcony is a ‘bolt-on’ architectural component, but not part of building enclosure
- → Air, water, and thermal control layers continuous behind pre-finished balcony
- → Simplifies detailing – no saddles
- → Continuous water, air, thermal layers

Current Project – Bay Area



Current Project – Bay Area

Make ‘bolt-on’ component out of durable material:
- Preservative treated wood
- Precast concrete (coated?)
- Coated steel

Precast Bolt-On Balconies

This concludes The American Institute of Architects Continuing Education Systems Course

Discussion + Questions

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