Building Enclosure Design & Practice

Where the Walls meet the Roof

Building Enclosure Council
BEC MINNESOTA

Tuesday, November 13, 2018
AIA Minnesota Conference

Sponsored by the Minnesota Building Enclosure Council (BEC)

Building Enclosure Council
BEC
MINNESOTA

OUR MISSION

The Minnesota Building Enclosure Council encourages anyone with an interest in achieving higher performing, resilient, and more energy-efficient buildings to join, learn, and make contributions.

BEC-MINNESOTA *https://**bec-mn**.org*

Interdisciplinary non-profit organization of architects, engineers, consultants, manufacturers, contractors, building officials, developers, owners, facility managers, educators, students, and other interested individuals with a common interest in promoting high-performing building enclosures. Our purpose is to:

- Promote and conduct discussion, training, education, technology transfer, research, and the exchange of information about all matters concerning the building enclosure and the related science;
- Initiate and promote dialogue between professions and among researchers, government, designers, manufacturers, suppliers, fabricators, contractors, building operators, developers, insurers, and others with an interest in the building enclosure; and
- Facilitate improvements in process, inspection, commissioning, approvals, codes, regulations, standards, quality control, liability matters, and the like for matters that affect the building enclosure.
- Monthly Meetings, May through September

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Learning Objectives

1. Overview of the 2015 Minnesota Building Code with specific references to the 2012 International Energy Conservation Code (IECC) and ASHRAE 90.1-2010 and how to interpret requirements for exterior enclosure systems.
2. Discuss challenges and solutions for continuous air, vapor, moisture, and thermal barriers and how they should be shown on the contract documents. Outline roles and responsibilities of the parties that design, detail, construct, and investigate these interface conditions.
3. Share lessons learned and offer best practices to achieve better and more predictable envelope performance, specifically at transitions including the wall to roof interface. Discussion of challenges and industry trends related to the materials and systems used as they evolve with applicable codes.
4. Understand the potential consequences of water and air leakage, condensation, and material incompatibility and provide potential solutions to address these concerns.

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Introduction

DISCUSSION PANEL:

- **Mohammed Lawal AIA** CEO Principal Architect
  LSE Architects
- **Chelsea Karrels Ames AIA** Senior Associate
  Wiss, Janney, Elstner Associates
- **Mike Spence FCSI, AIA** Vice President Building Science
  Kraus Anderson Construction
- **Lori Gunderson** Business Development Manager
  Hallmark Building Supplies
- **Greg Johnson** Project Manager
  WL Hall Building Supplies

MODERATORS:

- **Paul Whitenack AIA** Building Science Manager
  Kraus Anderson Construction
- **Jim Larson RA** Sole Proprietor
  James A. Larson Consulting Architect

KEY:

Architect

Manufacturer's Rep

Enclosure Consultant

Installing Subcontractor

General Contractor

INDIVIDUAL PERSPECTIVES ON ENCLOSURE DESIGN:

- *"Architects design the building enclosure from the outside in."*
- *"Despite amazing developments in computing and digital media, the challenge of enclosure detailing has not diminished; in many ways it has become overwhelming."*
- *"Three C's: Continuity, Compatibility, and Constructability."*
- *"Document quality varies greatly from one architect to another."*
- *"Existing conditions are not always accurately conveyed in details."*
- *"Details are often generic and not consistent with specified systems."*
- *"Details are different from other forms of graphic representation in architecture because they imply a relationship between materials and methods that is not apparent from delineation."*

Part 1: Design

How can design acknowledge the realities of performance and constructability ?

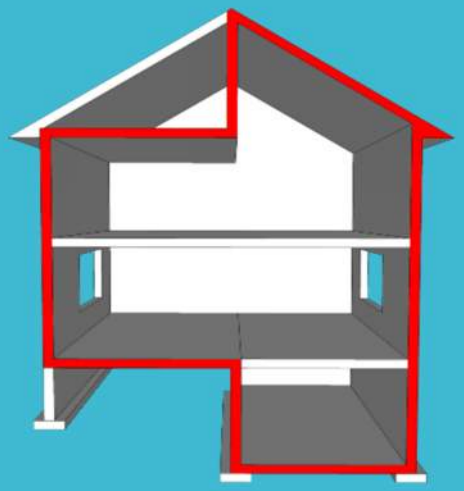
Enclosure vs. Envelope

"Envelopes are for FedEx; Enclosures are for Engineers"
Joseph Lstiburek

Which term shall we use?

- Facade, Shell, & Skin
  - Focus primarily on the visible portions of the building exterior
- Envelope & Enclosure
  - Synonymous words with slightly different connotations
  - Both terms commonly used for exterior wall and roof assemblies – no right or wrong term
  - Minnesota Code & Referenced Energy Standards use Envelope
  - Envelope suggests a more singular 'container'
  - Enclosure describes the intended function of system
  - Enclosure System, suggests a multi-layered assembly with a clearly stated purpose
- WRB, AWB, AVB…
  - Weather resistive barrier, Water resistive barrier, Air and Water barrier, Air and Vapor barrier
    - Each term can be appropriate, but meaning and performance expectations can vary greatly – use the term that bests describes intended function

Enclosure Components



*** Avoid "out of sight, out of mind" thinking!**

Building Enclosure - 4 basic components:

1) Roof covering systems
   a. Sloped: Metal Panel, Shingle
   b. Flat; Membranes:
      a. Asphaltic: BUR, Mod-bit
      b. Rubber: EPDM
      c. Plastic: TPO; PVC; KEE
      d. Liquid Applied : Kemper, etc.
   c. Substrate issues – vapor retarder; cover board *
2) Above-grade wall systems (including fenestration)
   a. Insulation type and placement
   b. Weather resistive barrier type and placement
   c. Cladding system and philosophy
      i. Barrier System
      ii. Drained Cavity
      iii. Open joint rain screen
3) Base Floor system
   a. Insulation; Under-slab vapor retarder *
4) Below-Grade wall systems
   a. ~~Damp proofing~~ vs. Water proofing *

Enclosure Assemblies

The overall building enclosure is a contiguous whole, formed by interconnected materials that :

- Are three-dimensional, multi-layered assemblies of specified materials and products
- Extend from interior to exterior, with exposure to differing environmental conditions on each side
- Are primarily intended to separate the interior environment from the exterior environment
- Provide the visible 'skin' of the building, including exterior facades and interior finish surfaces

SUPPORT FUNCTIONS

Superstructure

Hat Channels, Girts, Wall Ties, Anchors

CONTROL LAYERS

Air & Vapor Barriers

Control / Regulate Flow of Mass

- Air, Vapor, Liquids

Insulation

Control / Regulate Flow of Energy

- Heat / Cold, Sound

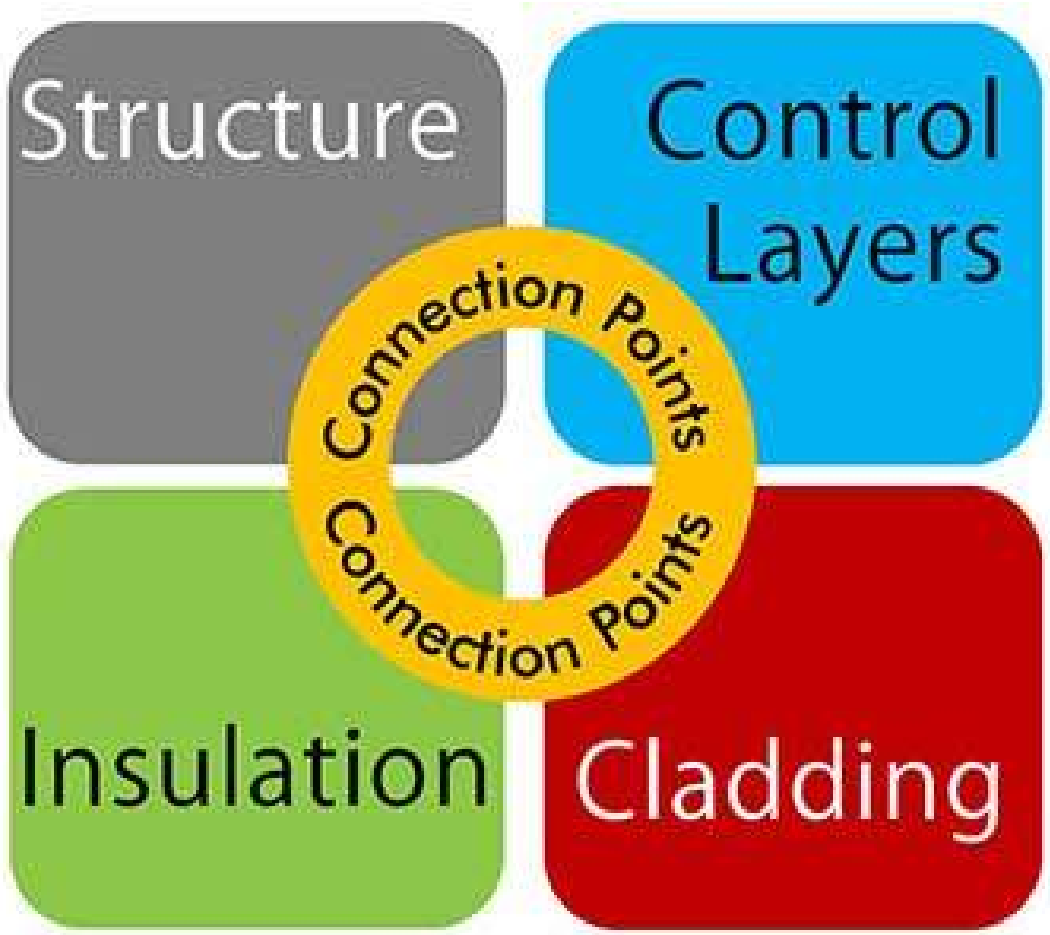
FINISH LAYERS

Interior & Exterior Finishes

Visual Aesthetics

Durability

Performance



Enclosure Control Layers

The primary systems to be incorporated into details and specifications include:

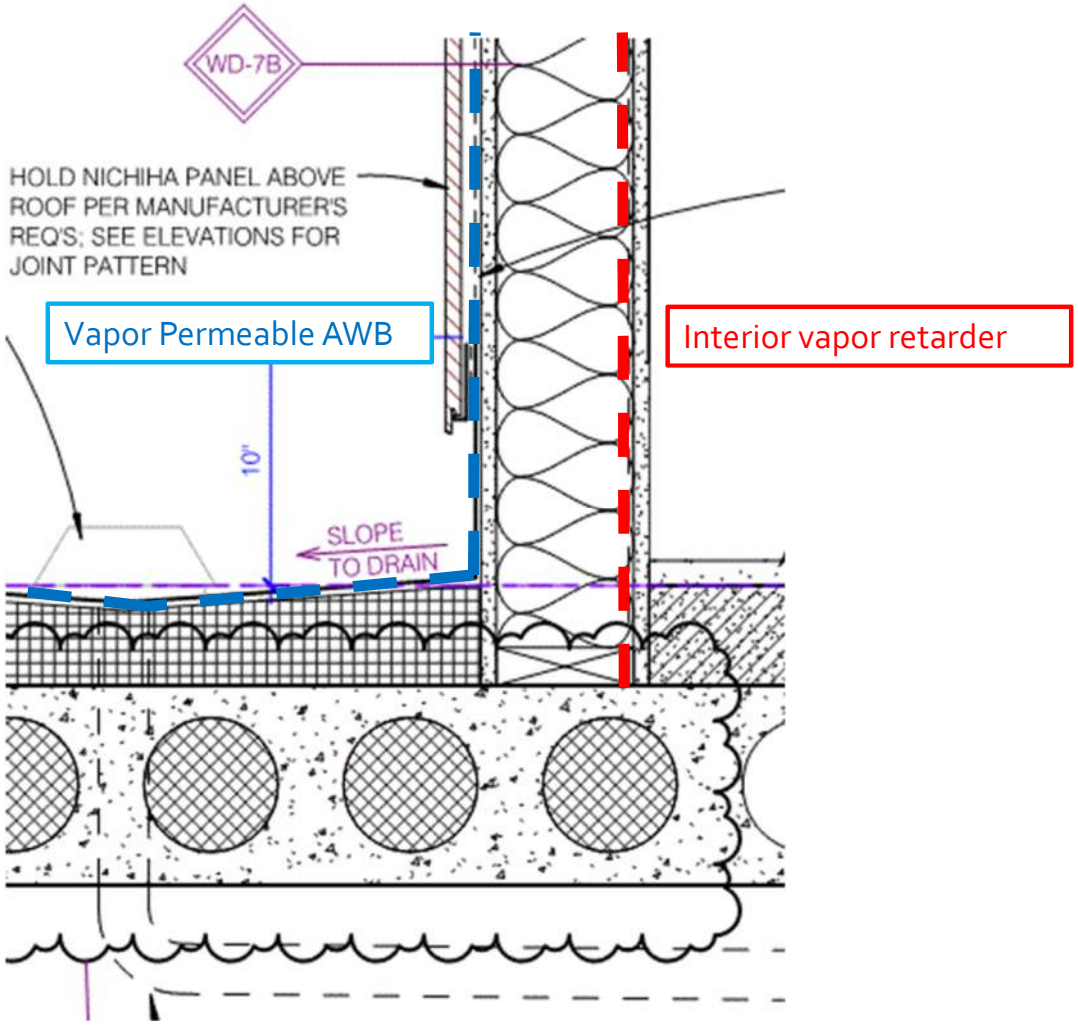
- Roof Coverings (air, water, vapor control / finish surface)
- **Vapor Retarders** (vapor control)
- **Insulation** (thermal control)
- **Air Barriers** (air, water & vapor control)
- Fenestration (air, water, thermal control / finish surface)
- Below Grade Waterproofing
- Claddings (finish surface / water control)
  - Flashing, Weeps, Support

Exterior Wall Design

TRADITIONAL DESIGN
Batts in Cavities

- Vapor permeable AWB
- Thermal Bridges abound
- Discontinuous vapor retarder
- Residential only, will be phased out of next code cycle
- **No longer permitted by Commercial Energy Code**

Get the batts out of the stud cavities!



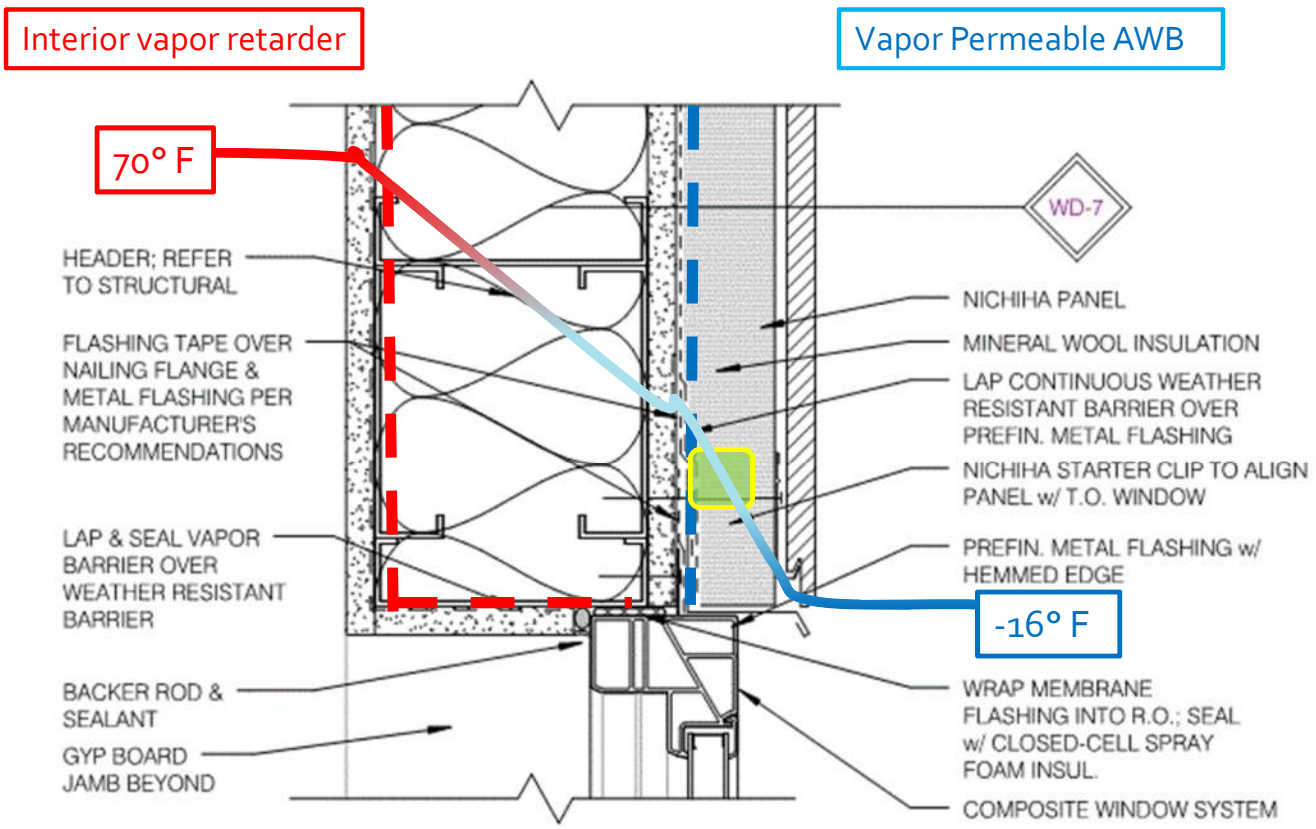
Exterior Wall Design

EVOLVING DESIGN

Hybrid Walls

- Vapor permeable AWB
- Thermal Bridges reduced
- Discontinuous vapor retarder
- CI exterior
- **Ensure that dew point occurs outboard of sheathing**

Air Temp (° F)	Relative Humidity (%)	Dew Point (° F)
68	30	35.4
68	35	39.3
70	30	37.1
70	35	41.1

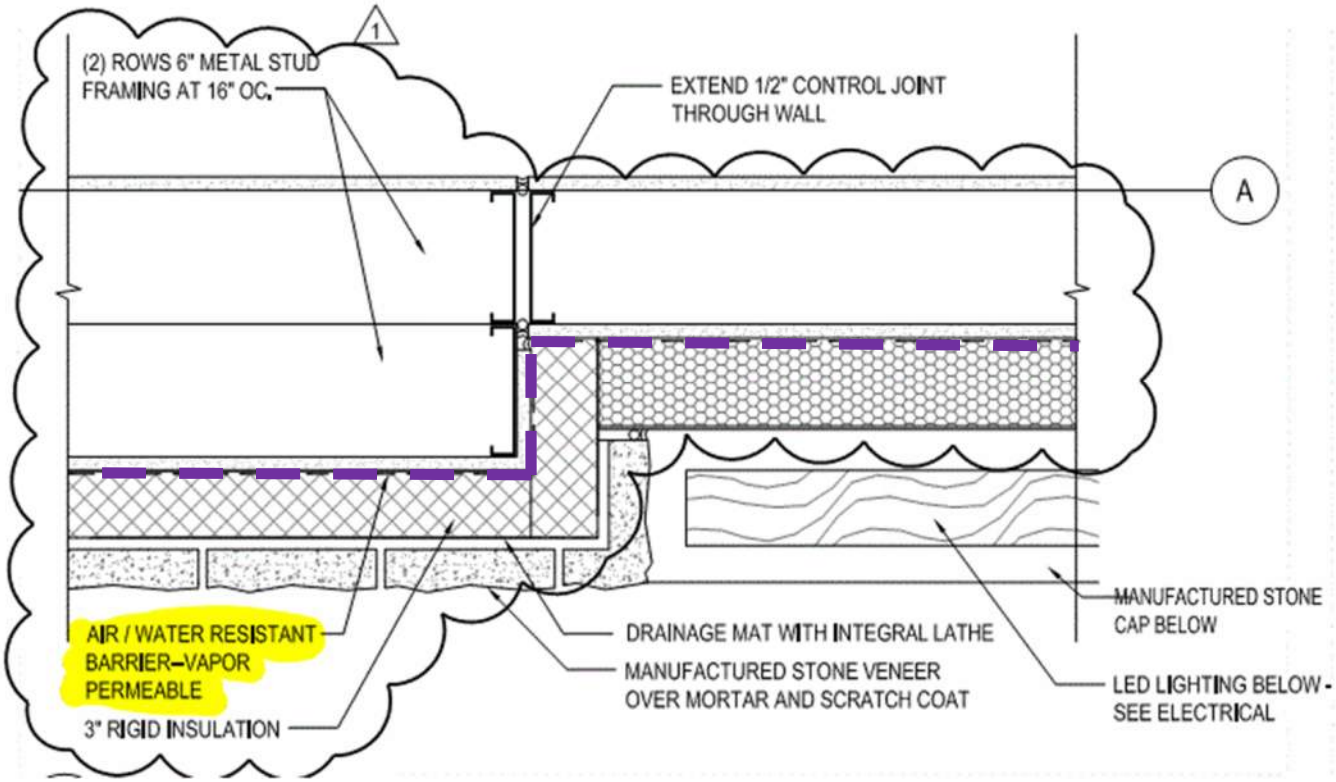


Exterior Wall Design

TRENDING DESIGN

CI Exterior

- Thermal Bridges *reduced*
  - Steel vs Non conductive furring, channels, clips
- **What's wrong with this detail?**

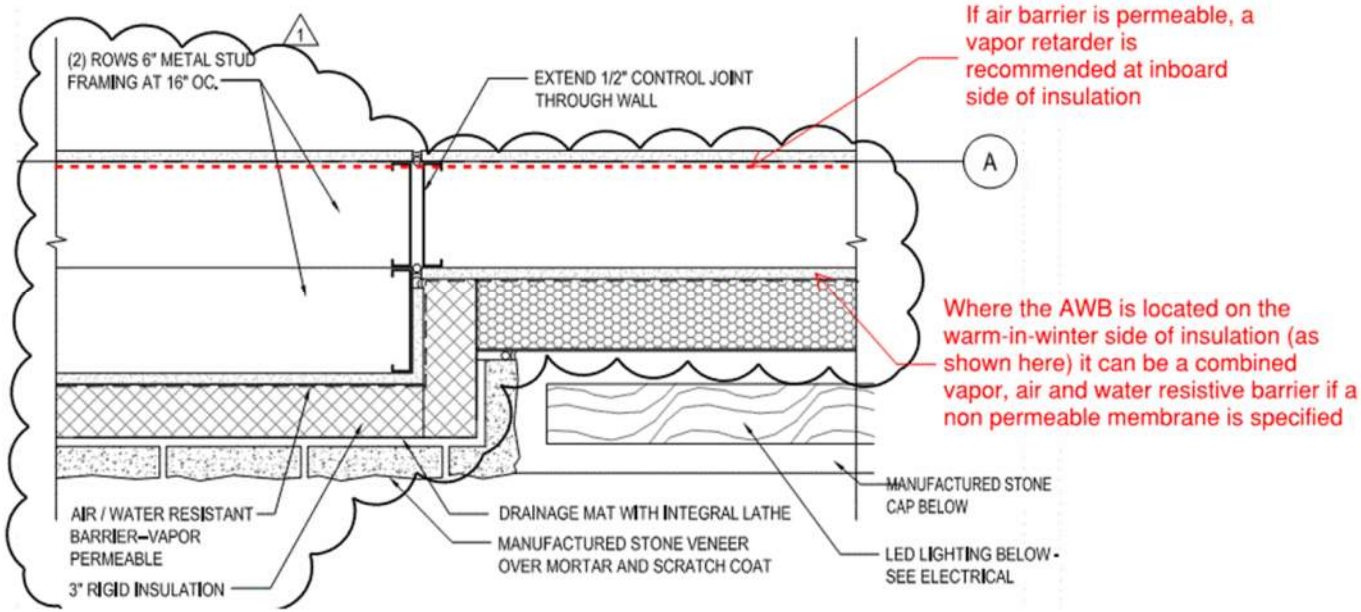


Exterior Wall Design

TRENDING DESIGN

CI Exterior

- Non permeable AWB = AVB
- All penetrations and edges of AVB must be sealed
- Furring, channels, clips?
- No interior vapor retarder
- CI exterior – must meet energy code minimum



Minnesota Building Code Requirements

CHAPTER 13
ENERGY EFFICIENCY

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ENERGY EFFICIENCY

SECTION 1301
GENERAL

[E] 1301.1 Scope.
This chapter governs the design and construction of buildings for energy efficiency.

[E] 1301.1.1 Criteria.
Buildings shall be designed and constructed in accordance with the *International Energy Conservation Code*.

Energy Codes & Standards

Energy codes are not design guides – they convey minimum performance requirements

1) **2015 Minnesota Building Code**
   a. **Chapter 13 – Energy Efficiency**
2) **2015 Minnesota Commercial Energy Code**
   a. International Energy Conservation Code (IECC) – 2012
      i. C – Commercial provisions
      ii. R – Residential provisions
   b. ASHRAE Energy Standard 90.1 -2010 Allowed alternate under IECC
      i. Chapter 5 Building Envelope
   c. Other Referenced Standards and Guidelines:
      i. AAMA: *North American Fenestration Standard for Windows, Doors & Unit Skylights*
      ii. ASHRAE 90.1: *Energy Standard for Buildings*
      iii. ASTM: *Test standards related to wall/roof assemblies and fenestration*
      iv. NFPA 285 – Upcoming BEC MN presentation
      v. NFRC (National Fenestration Rating Council)

Air Barriers
Energy Code Requirements

IECC and ASHRAE contain similar requirements for Air Barrier design

IECC C402.4.1 / ASHRAE 5.4.3.1 AIR BARRIER DESIGN

- A continuous air barrier shall be provided throughout the building thermal envelope. The air barriers shall be permitted to be located on the inside or outside of the building envelope, located within the assemblies composing the envelope, or any combination thereof.
- All air barrier components of each building envelope assembly *shall be clearly identified or noted on construction documents*.

IECC C402.4.1.1 / ASHRAE 5.4.3.1 AIR BARRIER INSTALLATION

- The air barrier shall be *continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.*
- Joints around Windows and doors, junctions between walls and floors, between walls at corners, and between walls and roofs shall be sealed
- Air barrier *joints and seams shall be sealed, including sealing transitions in places and changes in materials.* Air barrier penetrations shall be sealed…

Air Barriers

Energy Code Requirements

Q: What is missing from this list?

A: The proprietary products most often specified as air barriers.

IECC and ASHRAE allow a similar range of acceptable Air Barrier materials

IECC C402.4.1..2.1 / ASHRAE 5.4.3.1.3: ACCEPTABLE AIR BARRIER MATERIALS

Materials with an air permeability no greater than 0.004 cfm/ft2 under a pressure differential of… (75 Pa) when tested in accordance with ASTM E2178 shall comply with this section. Accepted air barrier materials include the following:

- Plywood / OSB ≥ 3/8" thick
- XPS / Foil backed polyiso Insulation ≥ 1/2" thick
- Closed Cell SPF ≥ 1 ½" thick
- Open Cell SPF ≥ 4 ½" thick *(IECC only - not ASHRAE)*
- Gypsum / Cement board ≥ 1/2" thick
- BUR / Mod-bit roof membranes
- ***Fully Adhered*** single ply roof membranes (not mechanically fastened)
- Portland cement / plaster parge coat ≥ 5/8" thick
- Cast in place or precast concrete
- ***Fully grouted*** CMU masonry
- Sheet Steel or aluminum

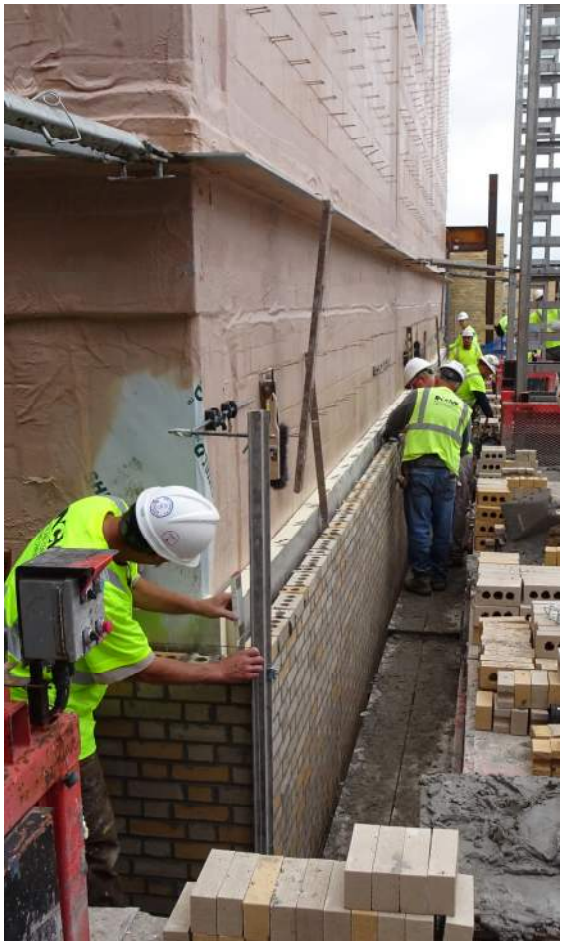
Proprietary Air Barriers

Attachment Options:

- Mechanically fastened sheets
- Self Adhering sheets
- Fluid-Applied
- Integrated Systems - *next month at BEC*

Considerations:

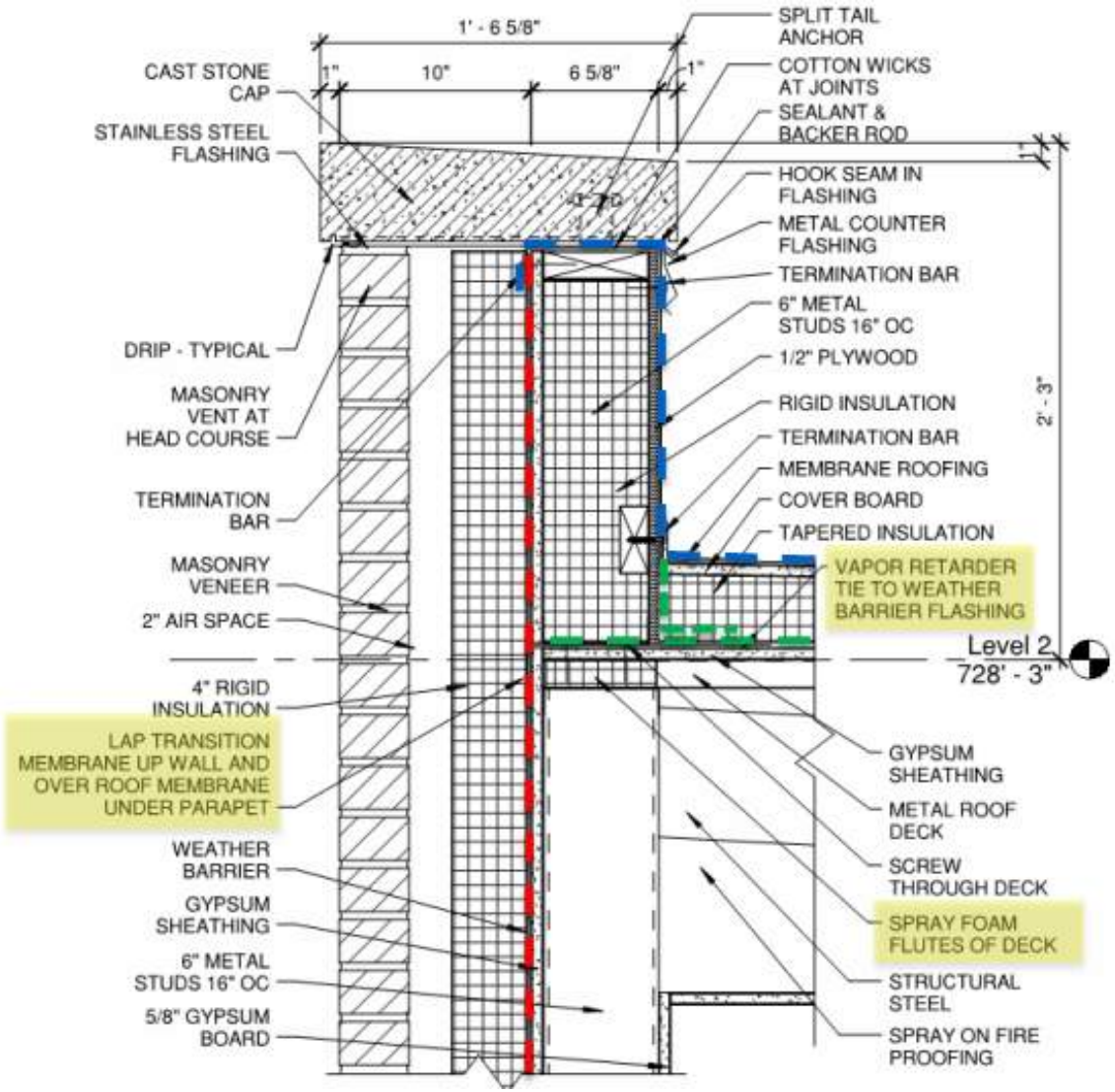
- Non Vapor-Permeable vs. Vapor Permeable
- Anticipated exposure duration
- Durability



Air Barriers

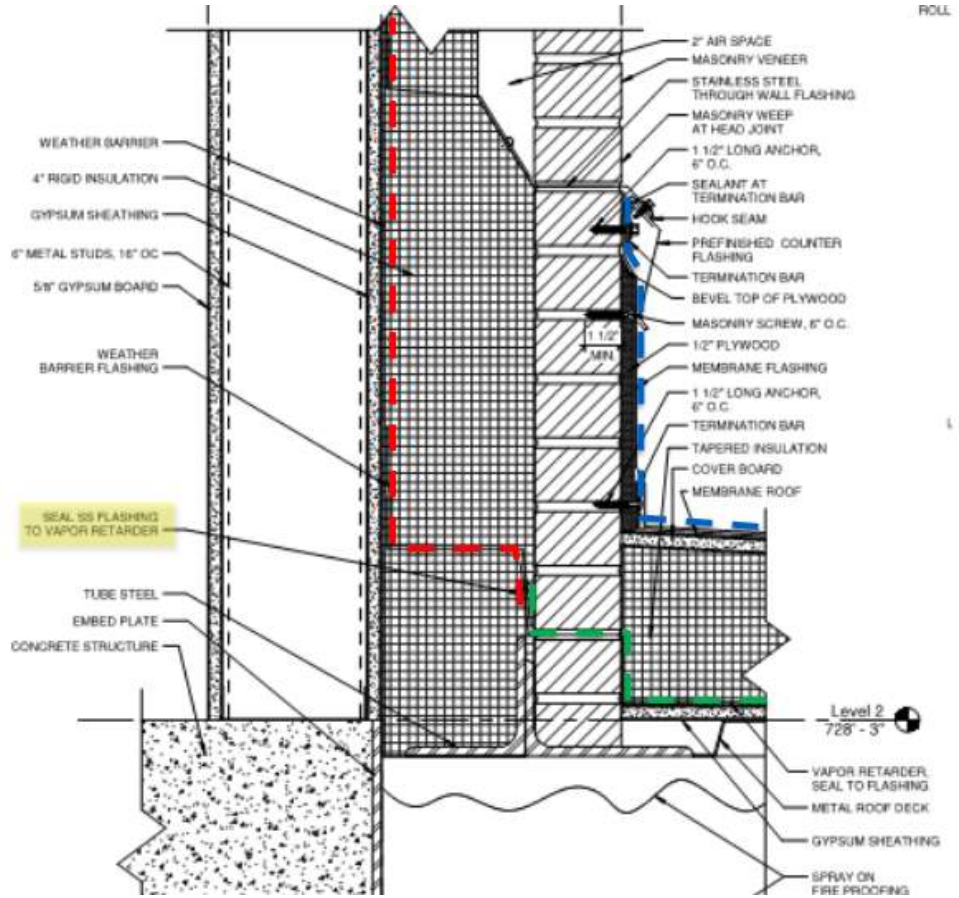
- ✓ Clearly identified and noted
- ✓ Continuous across assemblies
- ✓ Joints and seams are sealed at transitions and changes of materials

- Consider sequencing
- Ensure compatibility – plastic vs. rubber, etc.



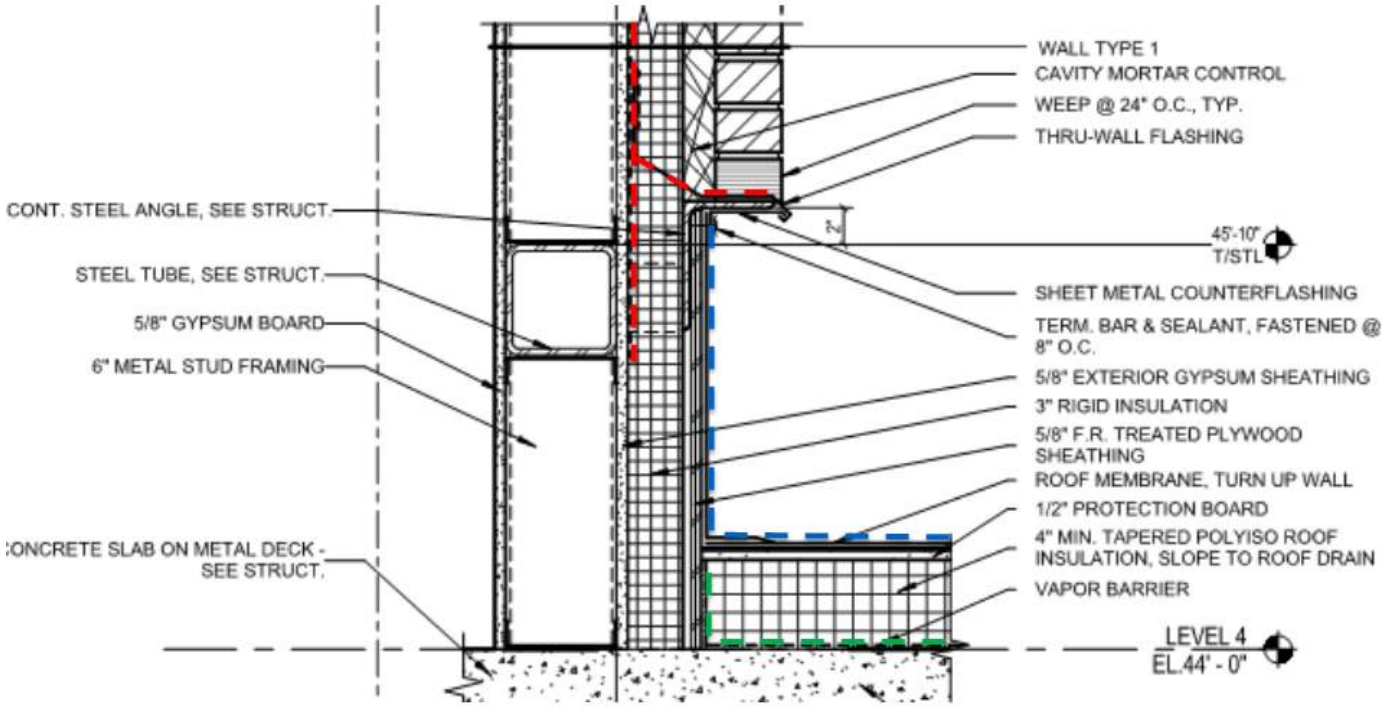
Air Barriers

- Combined system on Wall
- Split system on Roof (air barrier top and bottom)
- Wall AVB connected to rooftop vapor retarder – depending on spec roof VB can also be AB
- Roof membrane does not need to be air barrier - optional



Air Barriers

- Combined system on Wall
- Split system on Roof Assembly (air barrier top and bottom)
- Air barrier connected to vapor barrier via roofing membrane, shelf angle, and flashing
- Light colored roof membranes do not heat up enough to drive moisture back in – important to seal all bypasses at rooftop VB



Insulation

Energy Code Requirements

Commercial Opaque Thermal Requirements - Climate Zone 6*		
Roofs:	IECC 402.2	ASHRAE 5.5-6
Insulation Entirely Above Deck	R 30 ci	R 20 ci
Attic Insulation	R 49	R 38
Walls, Above Grade		
Mass	R 13.3 ci	R 13.3 ci
Steel Framed - *Assembly U 0.064*	R 13 + R 7.5 ci	R 13 + R 7.5 ci**
Wood Framed - *Assembly U 0.051*	R 13 + R 7.5 ci *or* R 20 + R 3.8 ci	R 13 + R 7.5 ci
Walls, Below Grade		
	R 7.5 ci	R 7.5 ci

Both IECC and ASHRAE require Continuous Insulation (ci) for Commercial wall designs

- *- Listed values are the same for Residential and Non-Residential applications except in Mass walls.*

** - *2015 Version increases value to R13 + R12.5 ci*

Vapor Retarders
Code Requirements

IECC and ASHRAE include no definitions or guidelines relating to vapor retarders

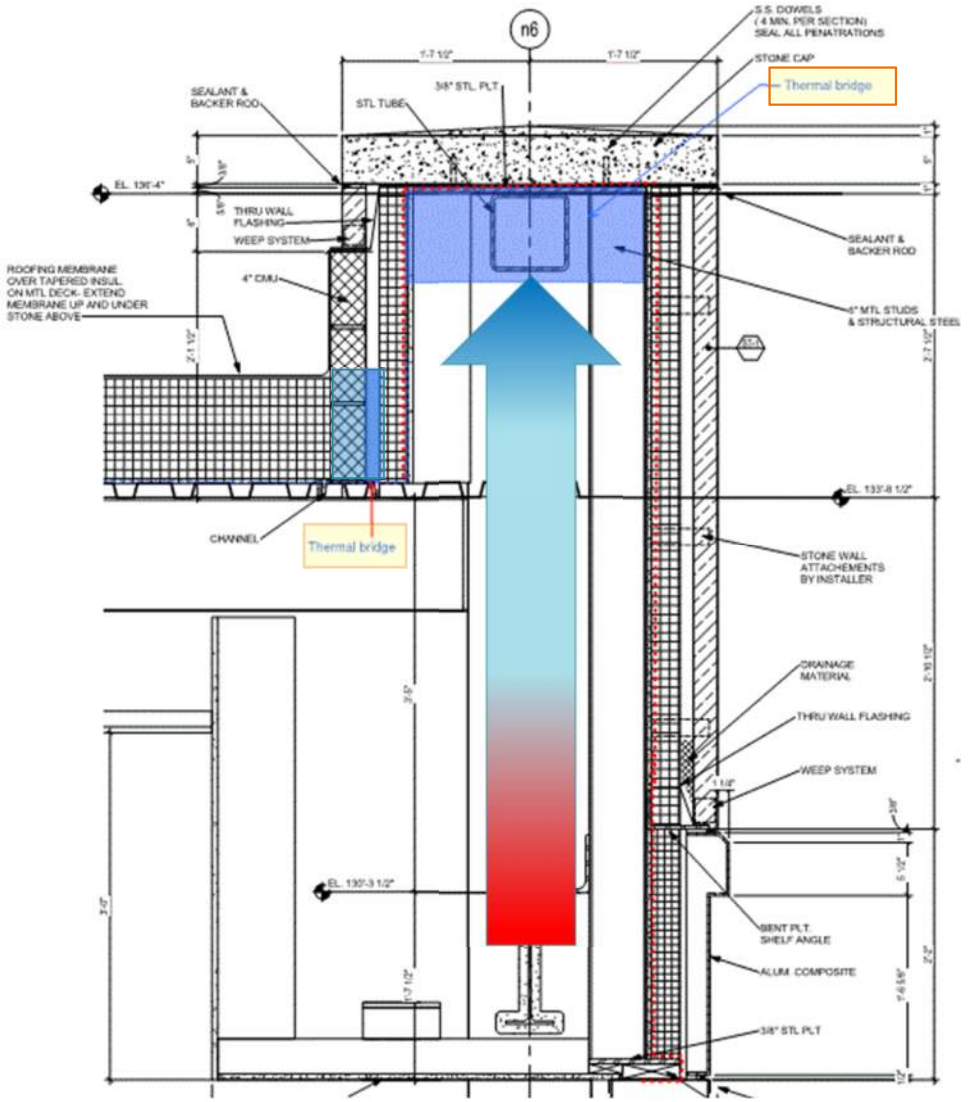
2015 MN BUILDING CODE - CHAPTER 14 - EXTERIOR WALLS

- 1405.3: "*Class I or II vapor retarders shall be provided on the interior side of frame walls…" Exceptions include:*
  - *Below grade walls*
  - *Construction where moisture or its freezing will not damage the materials*
- 1405.3.1: "*Class III vapor retarders shall be permitted" in Zone 6 for:*
  - *Vented Cladding over gypsum or fiberboard*
  - *Insulated Sheathing with R ≥ 7.5 over 2x4 wall framing*
  - *Insulated Sheathing with R ≥ 11.25 over 2x6 wall framing*
- 1405.3.2: Material vapor retarder class:
  - Class I (Vapor Barriers):
    - *Permeance rating ≤ 0.1 perm*
    - *Sheet Polyethylene, non-perforated aluminum foil*
  - Class II (Vapor Retarders):
    - *Permeance rating >0.1 and < 1.0 perms*
    - *Kraft Faced Fiberglass batts, or paint w perm rating >0.1 and < 1.0*
  - Class III (Semi Permeable):
    - *Permeance rating between 1 and 10 perms*
    - *Latex or enamel paint*

Vapor Retarders

Exterior Wall Vapor Retarders

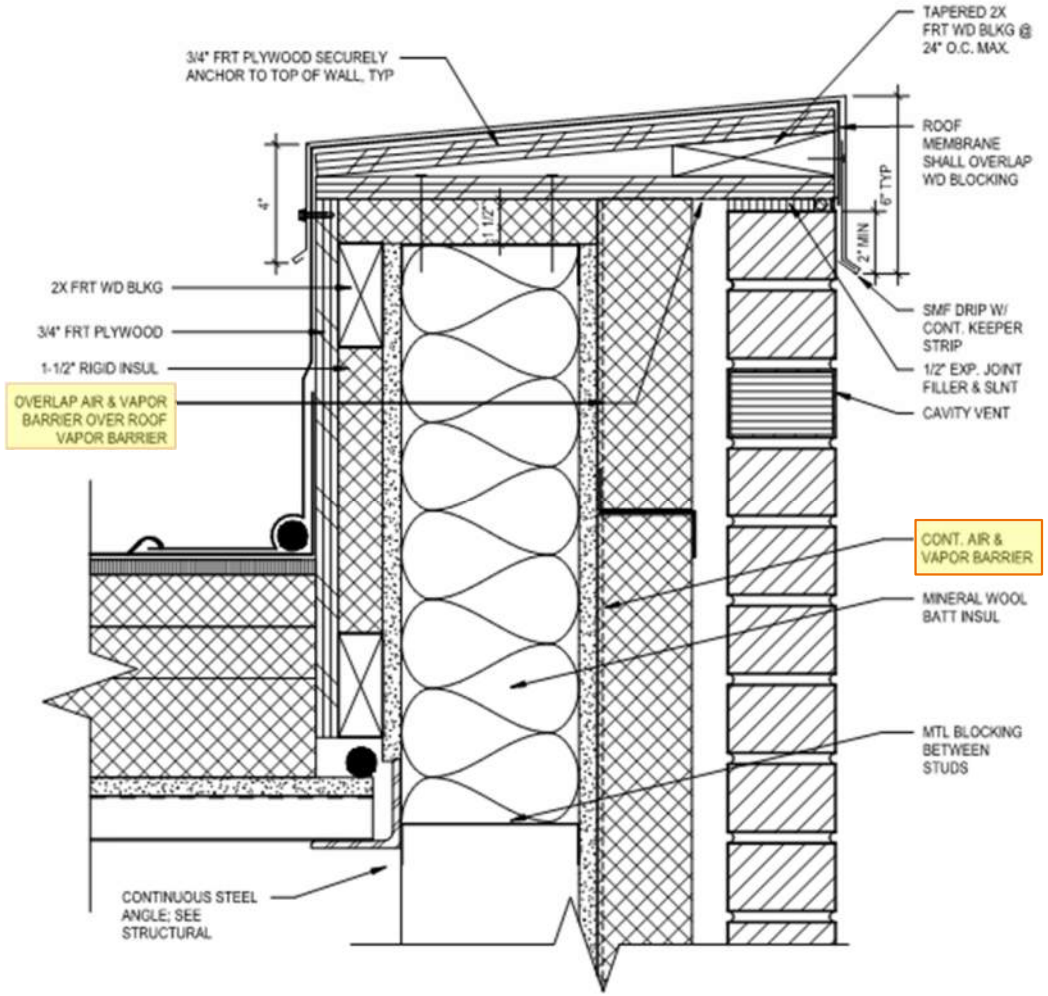
- Location depends on insulation and permeability of AWB
- Polyethylene vapor retarders
  - Careful attention needed to function effectively
- Spray Poylurethane Foam (SPF)
  - Closed cell can be a vapor barrier – not a "cure-all"
- Continuity / Bypass
  - Structural and mechanical interruptions
  - Vulnerable to stack effect



Vapor Retarders

Rooftop Vapor Retarders

- Yes or No?
- Connection to wall systems
- Continuity / Bypass
- This detail assumes the roof membrane to be a vapor barrier
  - Wrong side of insul.

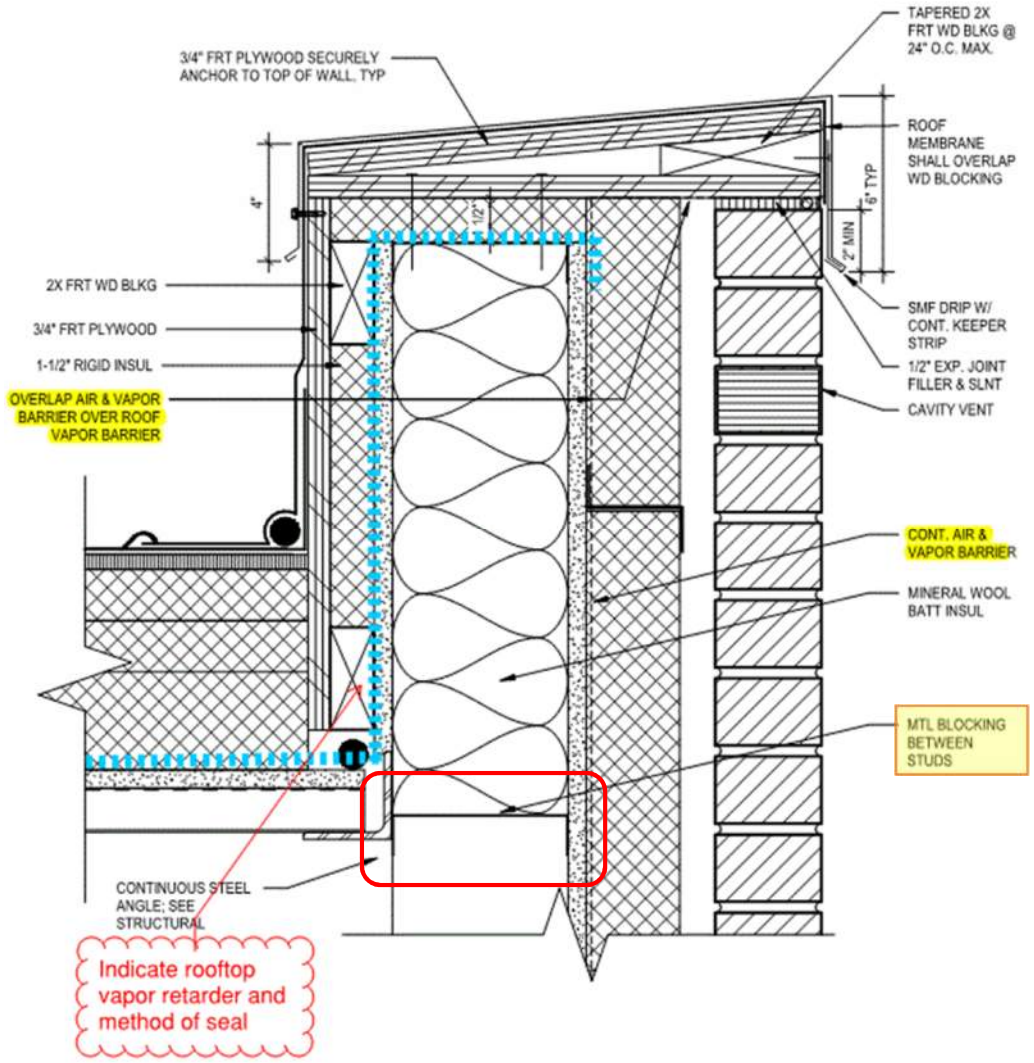


Vapor Retarders

CONTINUITY CHALLENGES

Rooftop Vapor Retarders

- **Yes – especially important with white roof membranes**
- Connect to AVB of exterior wall
- Seal edges, seams, penetrations
- Metal plates between studs will not effectively stop all air flow
  - Add seal with transition membrane or SPF



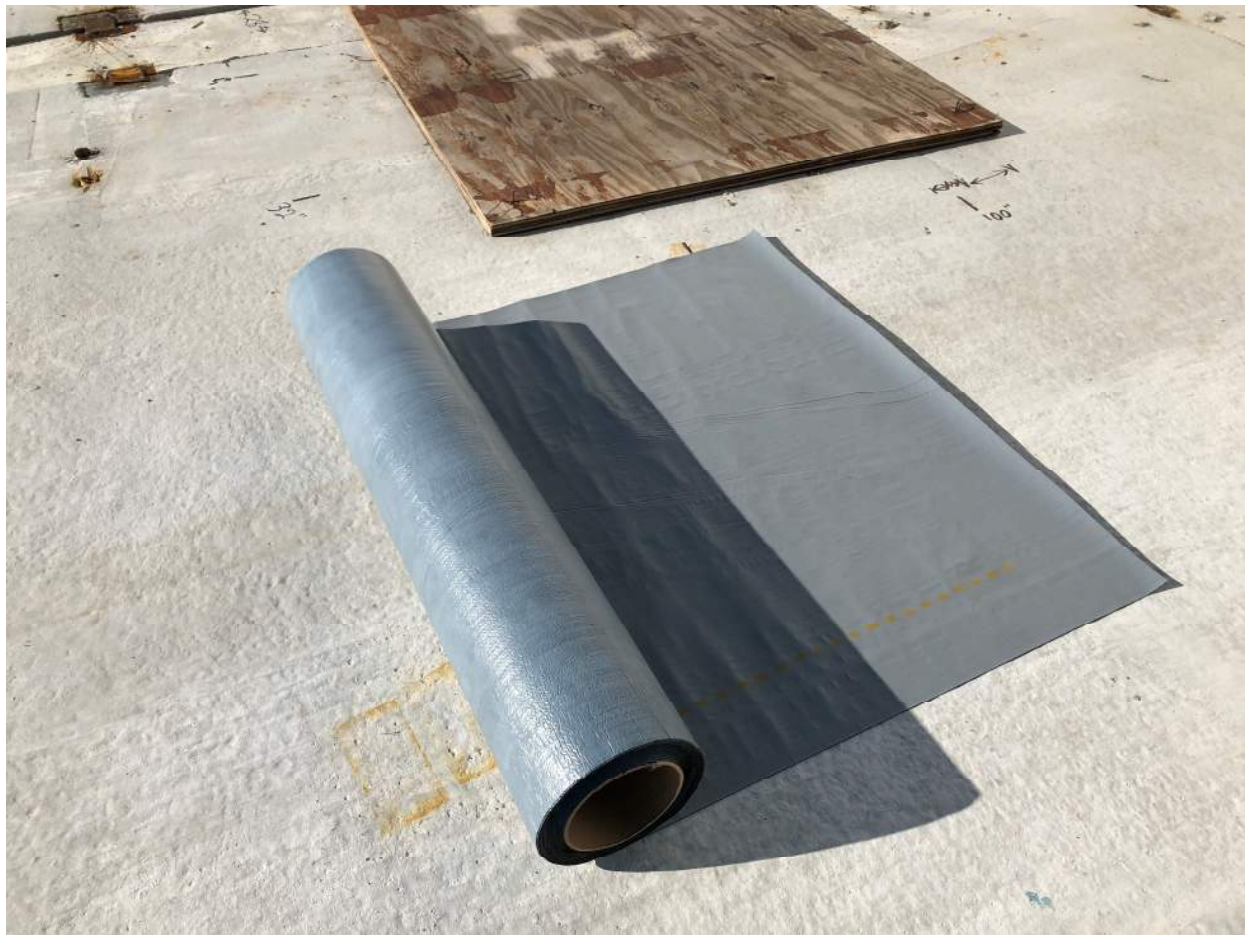
Vapor Retarders

- Billowed roof membrane
- No seal in parapet, allows air pumping in wall / roof assemblies
- Light roofs can be as much as 60° cooler - not warm enough to drive moisture back to interior. Condensation and frost can occur under membrane
- Air flow from interior can deliver moisture during construction – vapor barrier allows dry-in

Rooftop Vapor Retarders

- Perm rating ≤1.0
- Dry-in enclosure: Controls rising moisture vapor from the building during construction
- Adhered membranes and fluid-applied systems outperform polyethylene sheets *

*** Avoid "out of sight, out of mind" thinking!**



Fenestration

Energy Code Requirements

Criteria and performance requirements are similar for IECC and ASHRAE

VERTICAL FENESTRATION AREA

- ASHRAE 5.5.4.2.1: Total vertical fenestration area <40% of gross wall area
- IECC C402.3.1: Vertical fenestration area (vision glass) <30% of gross wall area
  - Can be increased to 40% if daylighting controls and high performance glazing used

AIR LEAKAGE CRITERIA (both standards match)

- Both standards specify test pressure of 1.57 psf per ASTM E283:
  - Curtain wall and Storefront glazing: 0.06 cfm max
  - Punched windows, sliding & swing doors: 0.20 cfm max

Fenestration

Energy Code Requirements

Criteria and performance requirements vary slightly between IECC and ASHRAE

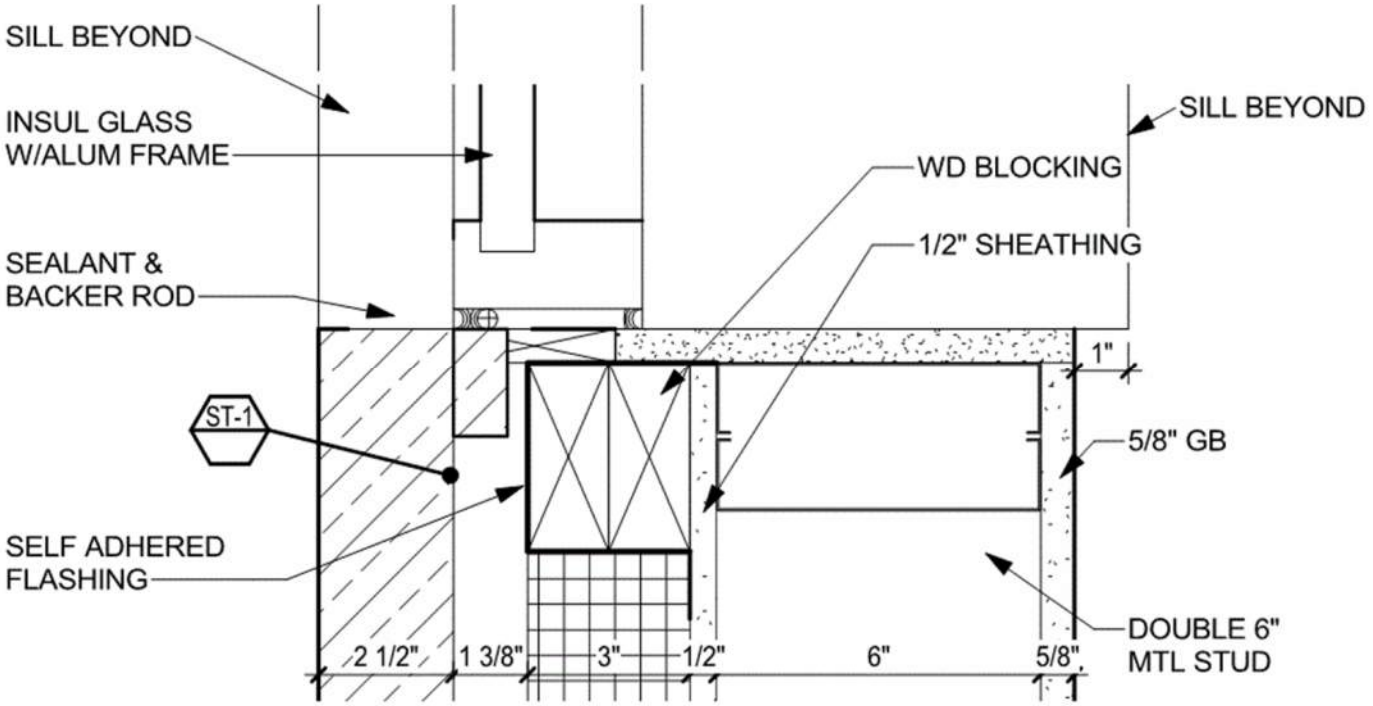
IECC table C402.3 Commercial Vertical Glazing Requirements - Climate Zone 6		
Fenestration Type:	Assembly Max U:	Max SHGC:
Fixed Fenestration	U 0.36 (R 2.78)	0.40
Operable Fenestration	U 0.43 (R 2.33)	" "
Entrance Doors	U 0.77 (R 1.3)	" "

ASHRAE 90.1 Non-Residential Vertical Glazing Requirements - Climate Zone 6		
Frame Type:	Assembly Max U:	Max SHGC:
Non-Metal Framing	U 0.34 (R 2.9)	0.40
Metal Framed Curtain Wall / Storefront	U 0.45 (R 2.22)	" "
Metal Framing	U 0.55 (R 1.8)	" "
Metal Framed Entrance Doors	U 0.80 (R 1.25)	" "

Fenestration

CONTINUITY CHALLENGES

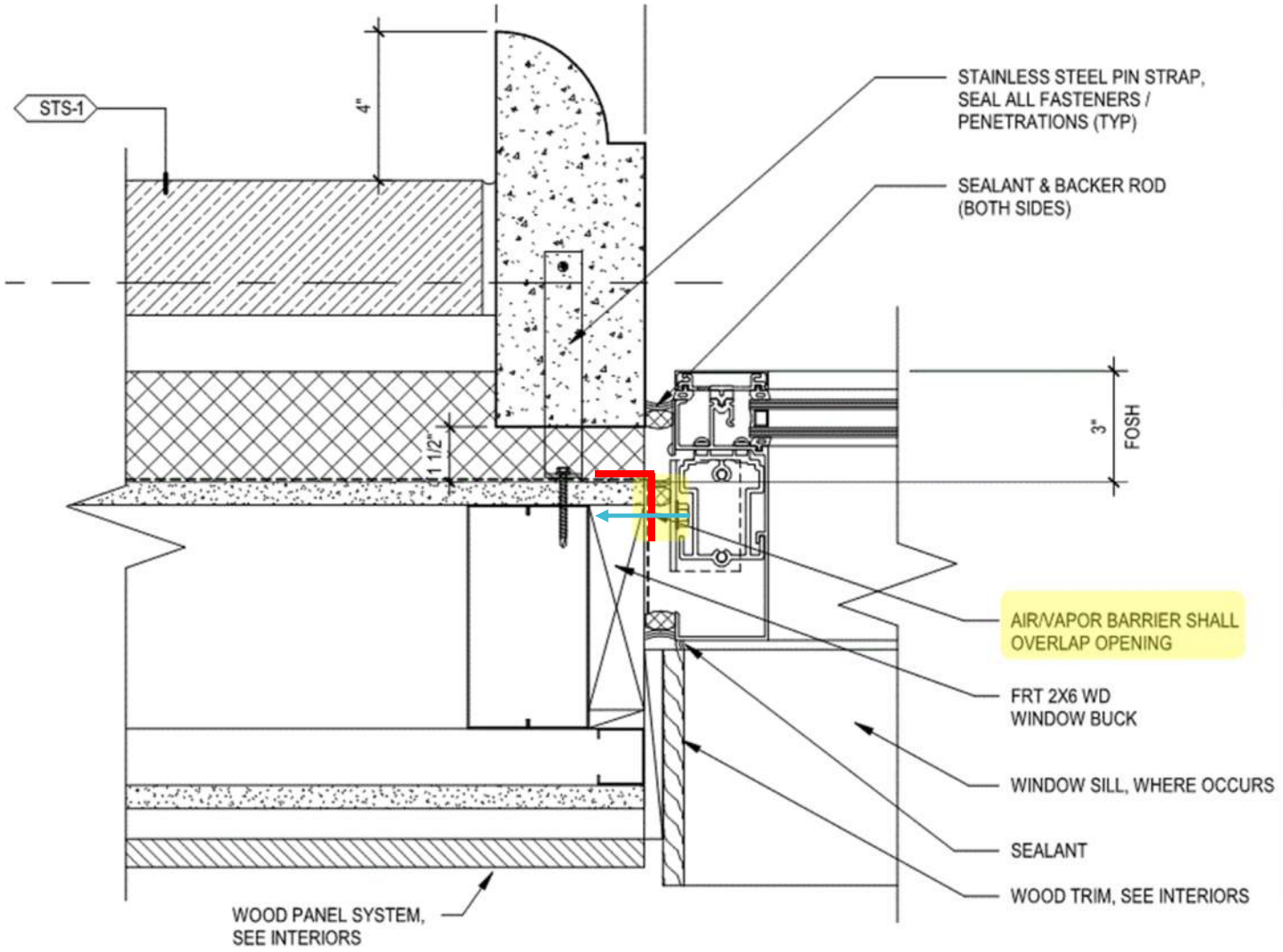
- Accurately depict glazing profile (Window, Storefront, and Curtain Wall frames differ)
- Align IGU with insulation – warm side of thermal break must be inboard of seal
- Reduce / omit blocking
- Primary seal must connect AWB to window frame
  - Mull cap to cladding is not primary seal!
  - Same location around entire perimeter
  - Sealant, gaskets, silicone boots, ETA's can all serve as primary seal



Fenestration

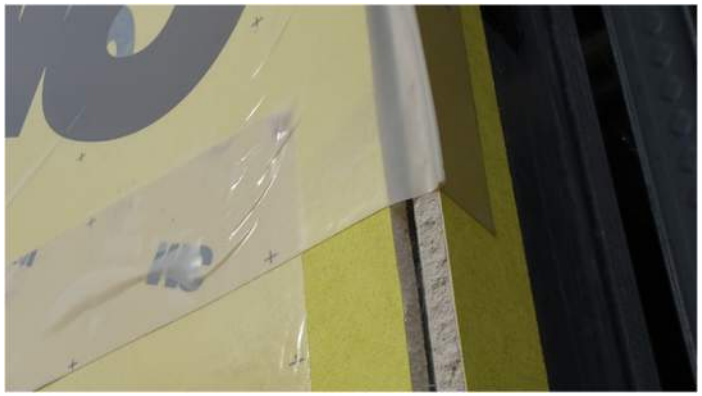
CONTINUITY SOLUTIONS

- ✓ Accurately depict frame type
- ✓ Cavity Seal to protect frame from cold air within wall cavity
- ✓ Primary seal connects AVB to window frame and is consistently located around R.O. perimeter
- • Anchorage should be indicated
- • Some AVB's may require added protection within rough opening – TW flashings, angles to move sealant joint outboard, etc. – if not detailed but needed later these can impact cost



Fenestration

- Primary seal location and quality is critical
- Actual construction seldom matches precision of details
- Some tolerance and variability should be accounted for

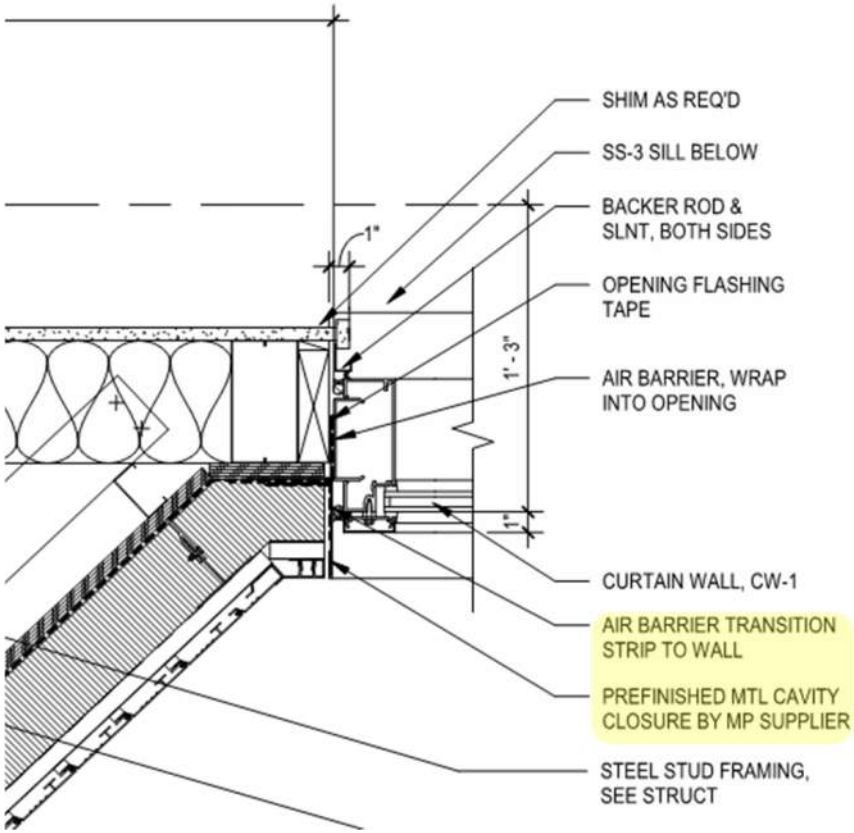


Fenestration

- Additional flashings, components not shown in the details can impact cost and schedule when added later

DETAIL AT RIGHT:

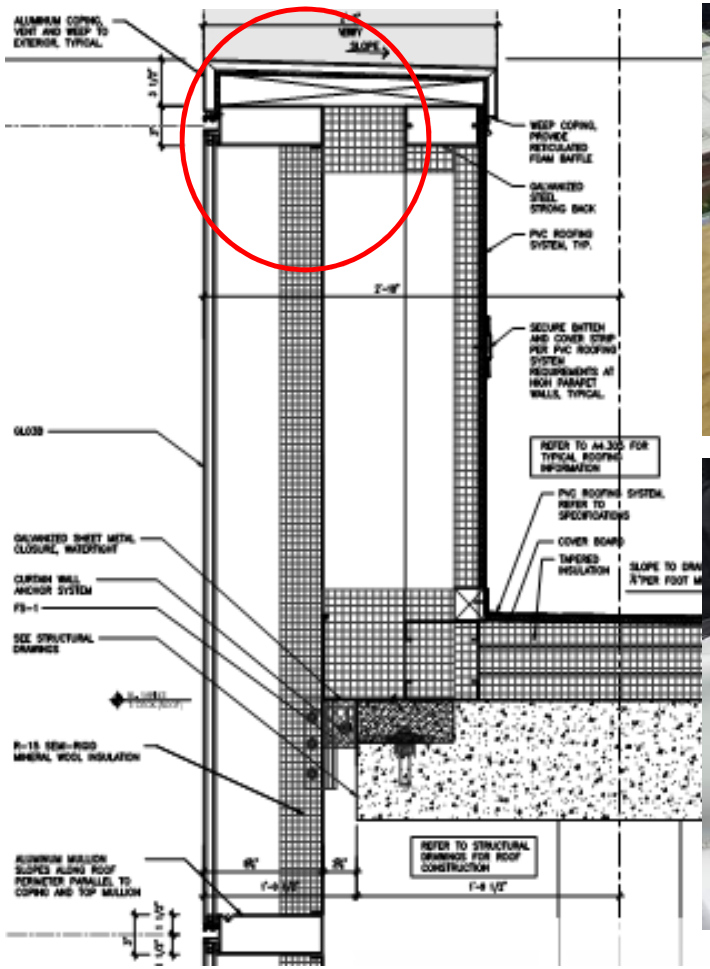
- ✓ Accurately depict frame type
- ✓ Cavity Seal to protect frame from cold air within wall cavity
- ✓ Primary seal connects AVB to window frame and is

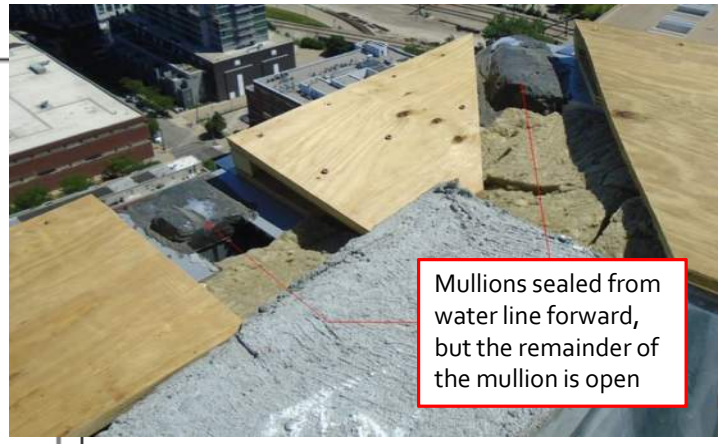


Fenestration

CONTINUITY CHALLENGES
Curtain Wall Parapets

- No mullion seals in continuous vertical mulls
- Terminate roofing in glazing pocket or seal to frame
- Continuity / Bypass

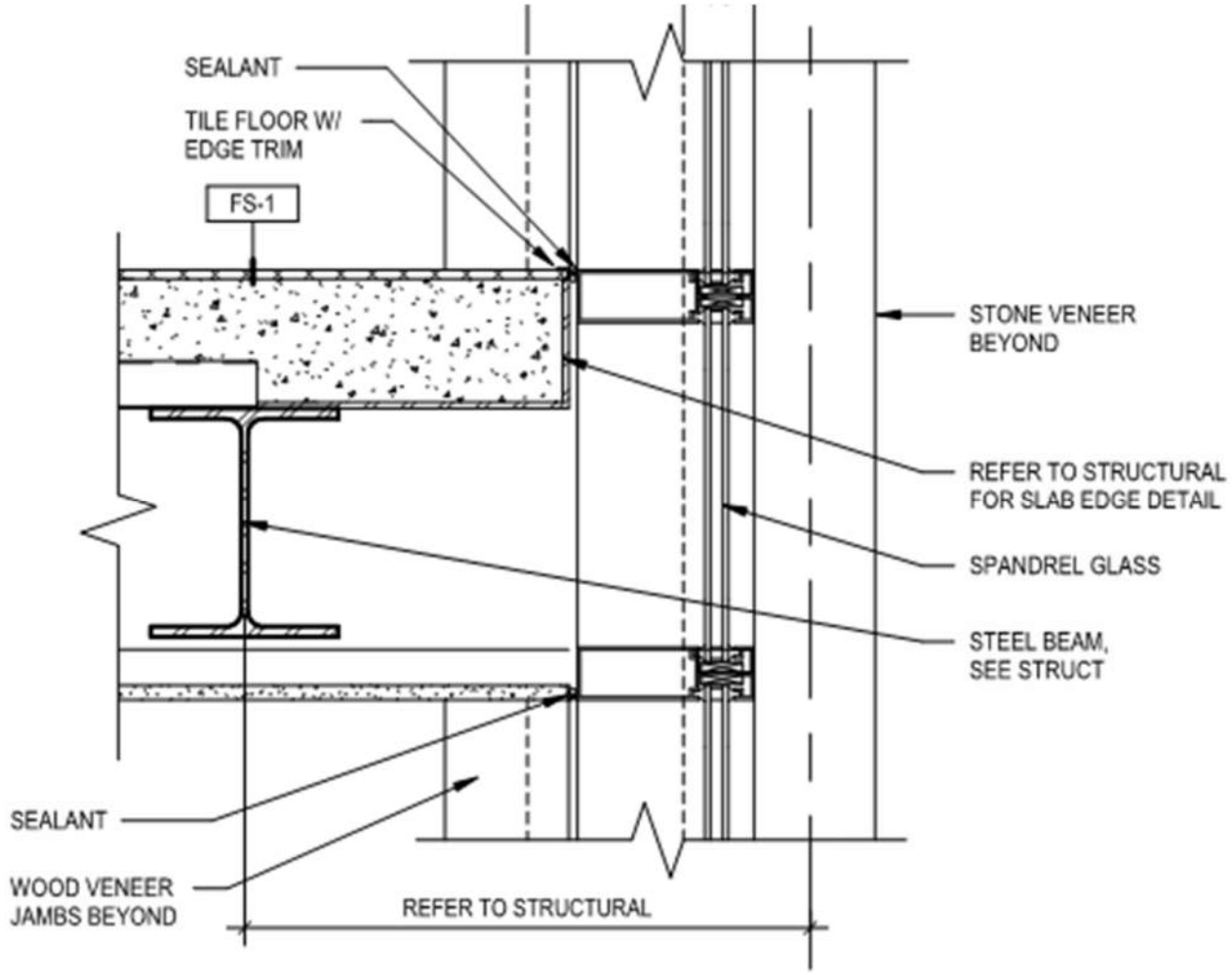




Fenestration

ENCLOSURE CHALLENGES

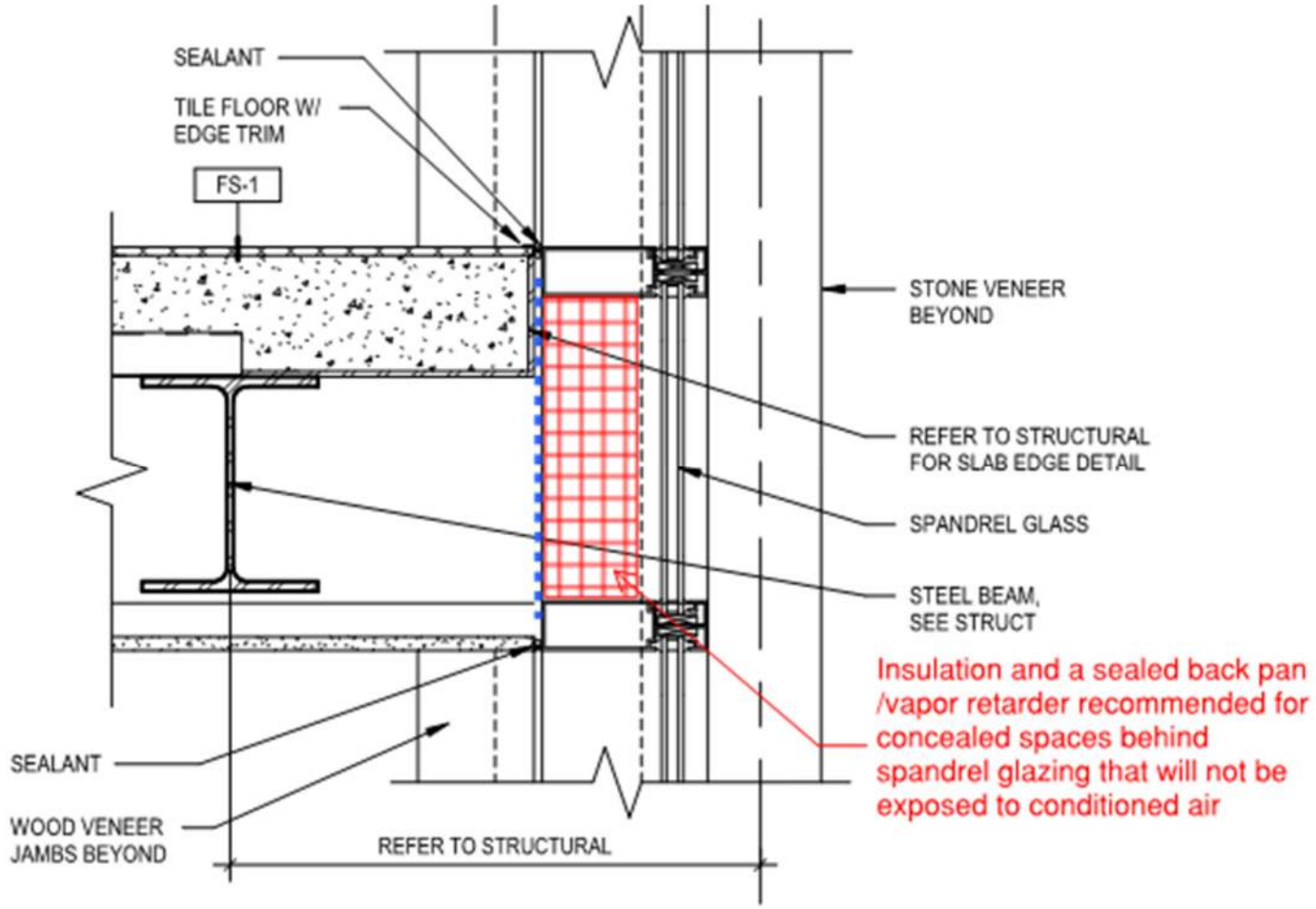
- Captured, unconditioned space behind spandrel glazing
- Allow adequate space between spandrel and back of system for construction tolerances

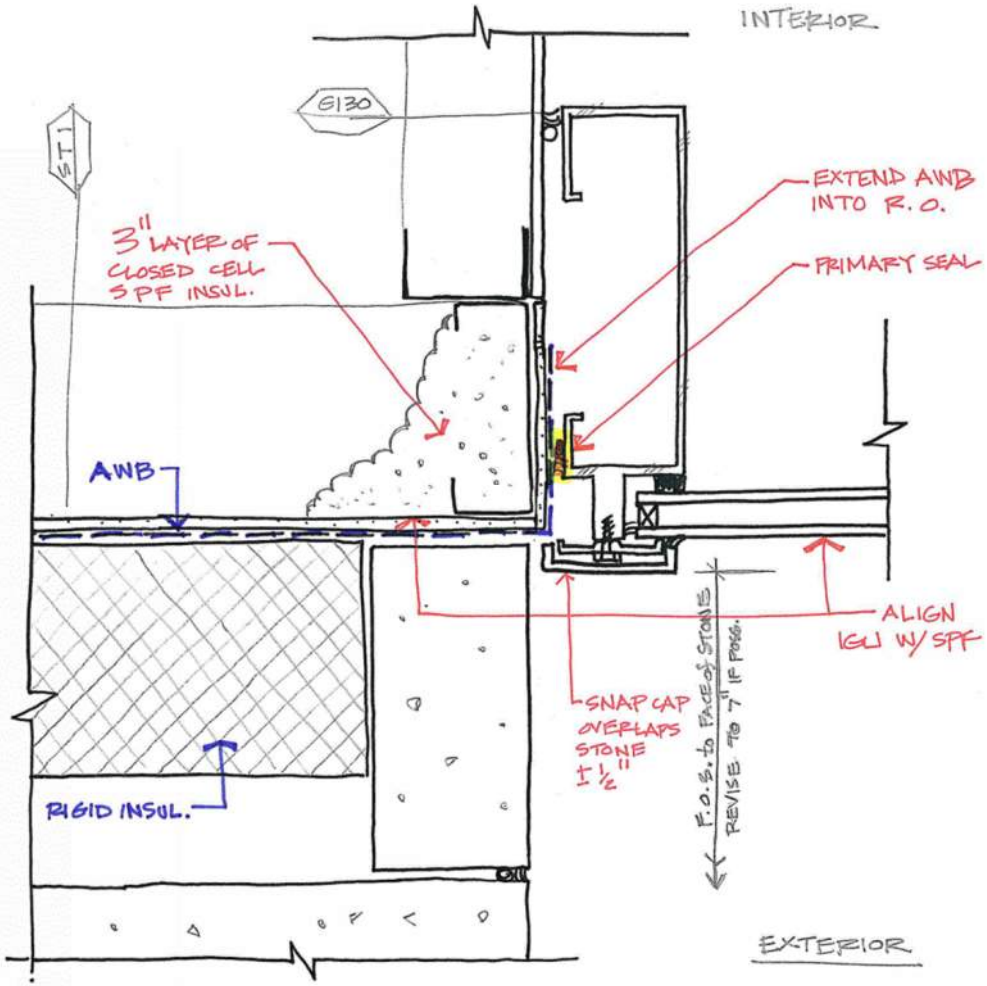


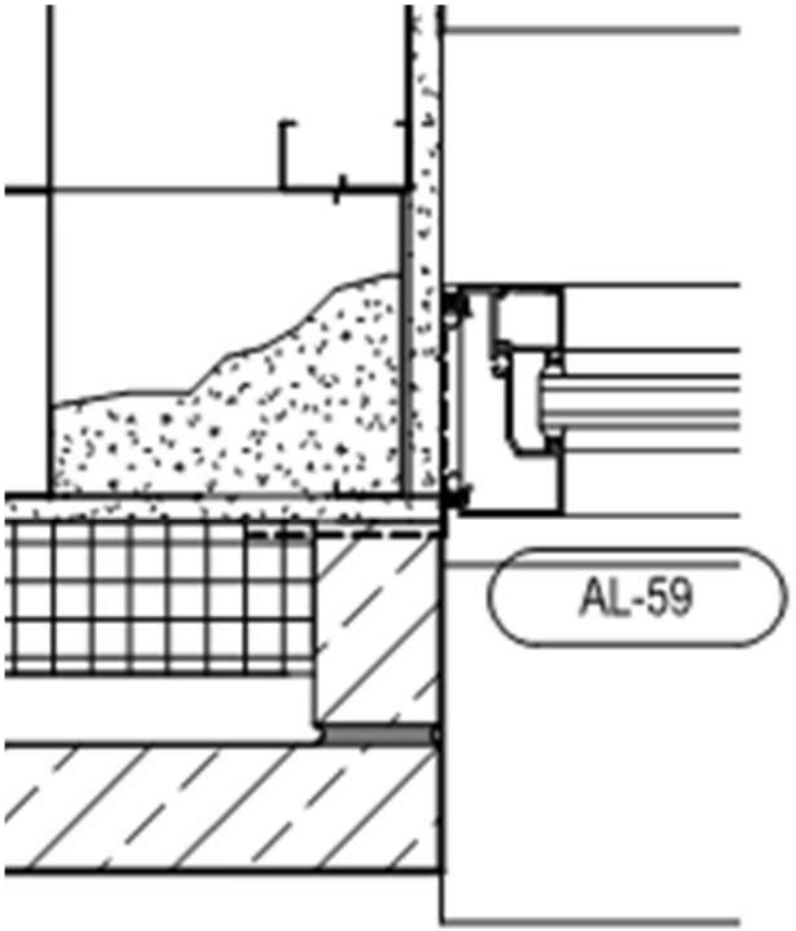
Fenestration

CONTINUITY SOLUTIONS

- ✓ Sealed and insulated back pans behind spandrel glass
- ✓ Move system away from spandrel, 1 inch min.




INTERIOR
G130
ST1
3" LAYER OF CLOSED CELL 5PF INSUL.
EXTEND AWB INTO R.O.
PRIMARY SEAL
AWB
ALIGN IGU W/ SPF
SNAP CAP OVERLAPS STONE 1 1/2"
F.O.S. to FACE of STONES
REVISE TO 7" IF POSS.
RIGID INSUL.
EXTERIOR


AL-59

KEY:
Architect
Manufacturer's Rep
Enclosure Consultant
Installing Subcontractor
General Contractor

Team perspectives on enclosure design / construction:

- *"Who decides when Design gives way to Means and Methods?"*
- *"Delegated Design does not absolve the architect of their responsibility to create clear enclosure details."*
- *"What does the air barrier want to be?"*
- *"Architects deal with products, Contractors deal with relationships."*
- *"Failures rarely happen where the section cut is drawn" (if I travel laterally along this detail, what will I run in to? What happens at corners, fasteners, etc.?)*
- *"Is our enclosure system compliant with the Energy Codes?"*
- *"What will make this detail succeed? – What will make this detail fail?"*
- *"Who drew this detail, and what were they thinking?"*

Part 2: Practice

How have enclosure details evolved over time to achieve continuity & code compliance?

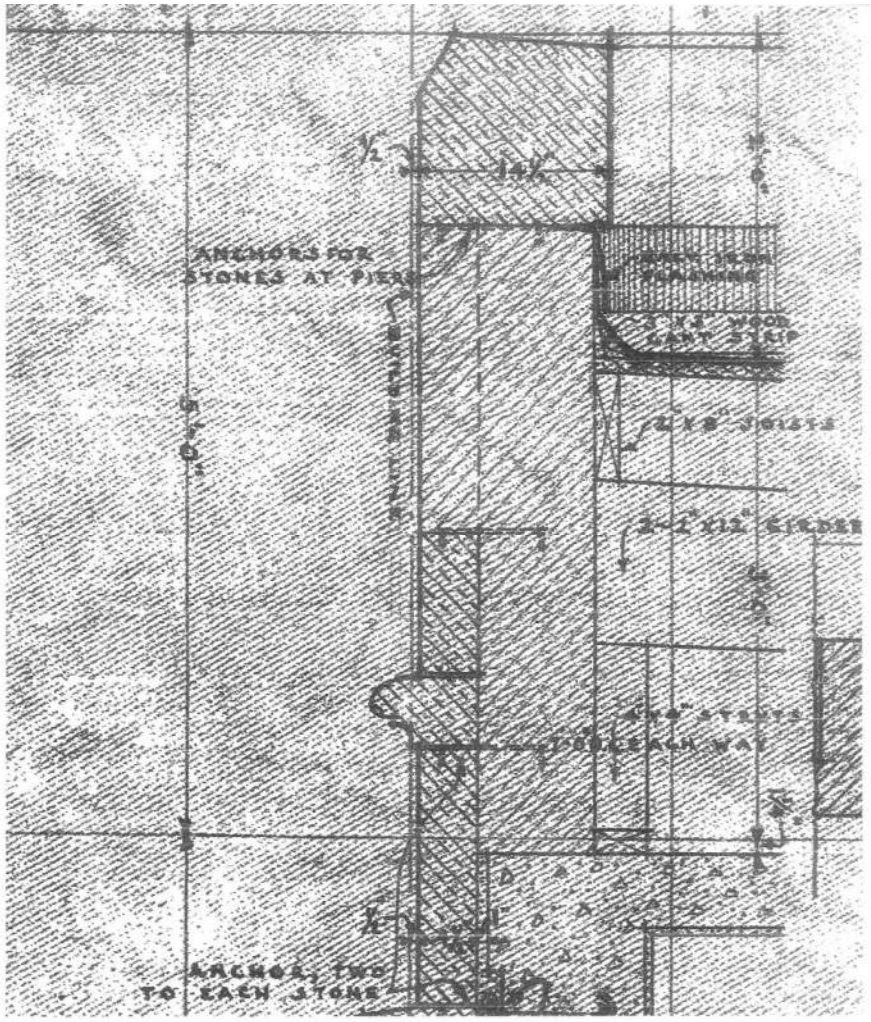
Enclosure Details
Considerations

- CONTEXT
  - Construction type, R-value goals/requirements
  - Can the amount of wall and roof types be simplified and condensed?
- LOAD PATH
  - Structural
  - Thermal
  - Drainage Plane
  - Air and Vapor flow
- BOUNDARY CONDITIONS
  - Climate zone, wind and solar exposure
  - Unique interior climates
- CONSTRUCTABILITY
  - Reasonable trade sequences
  - Temperature and environmental conditions at time of construction
  - Maintenance implications for extended service life

Early Attempts

LATE 19TH CENTURY

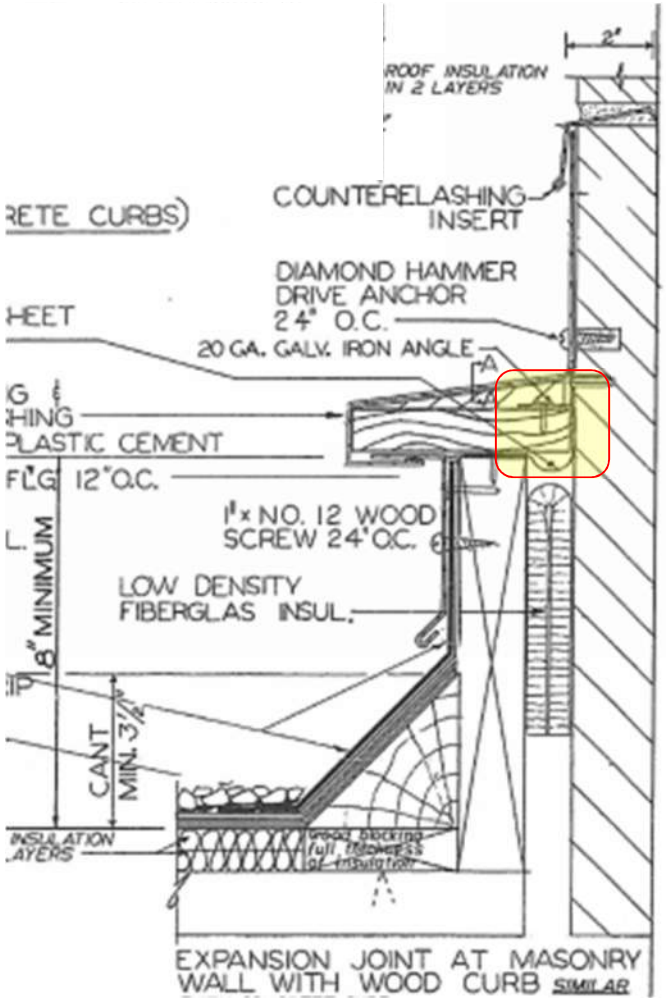
- Mass masonry wall / parapet
- Keep the water out
- No insulation, vapor barrier, or air barrier



Early Attempts

EARLY 20TH CENTURY

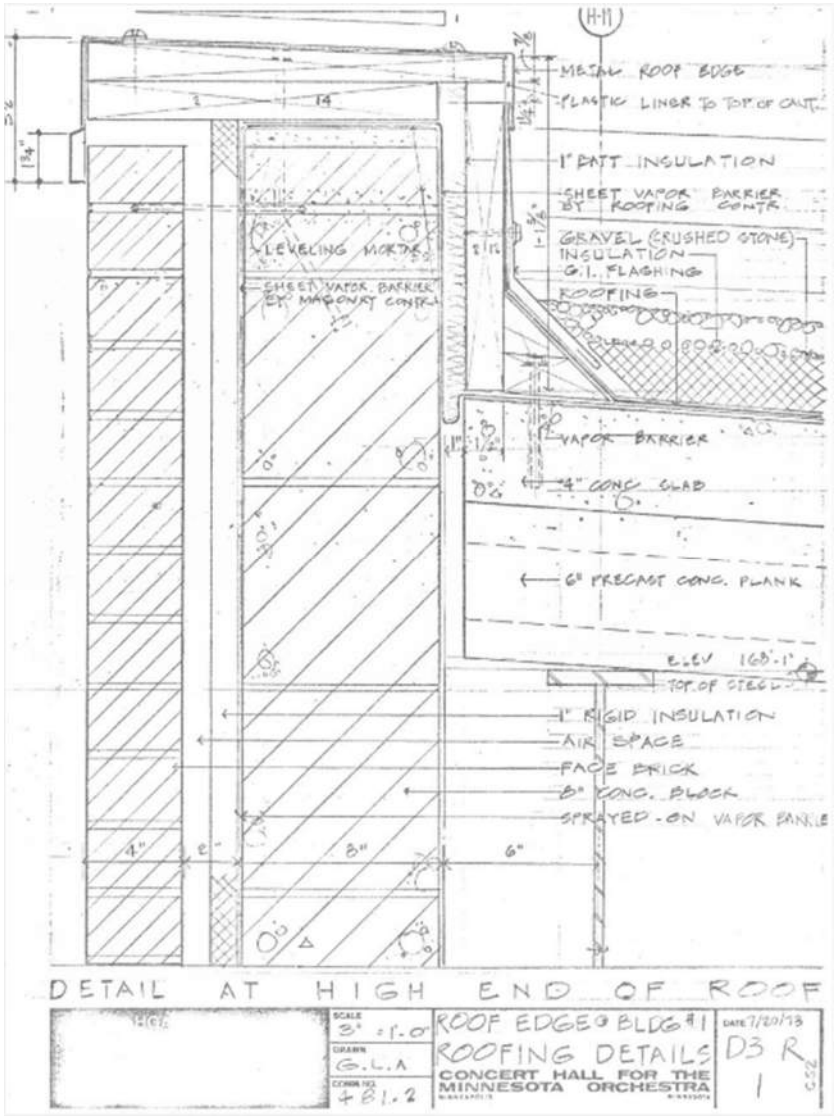
- Roof membrane only
- No rooftop vapor barrier
- "Air stop" at interface



System Development

Block parapet detail, ca. 1973

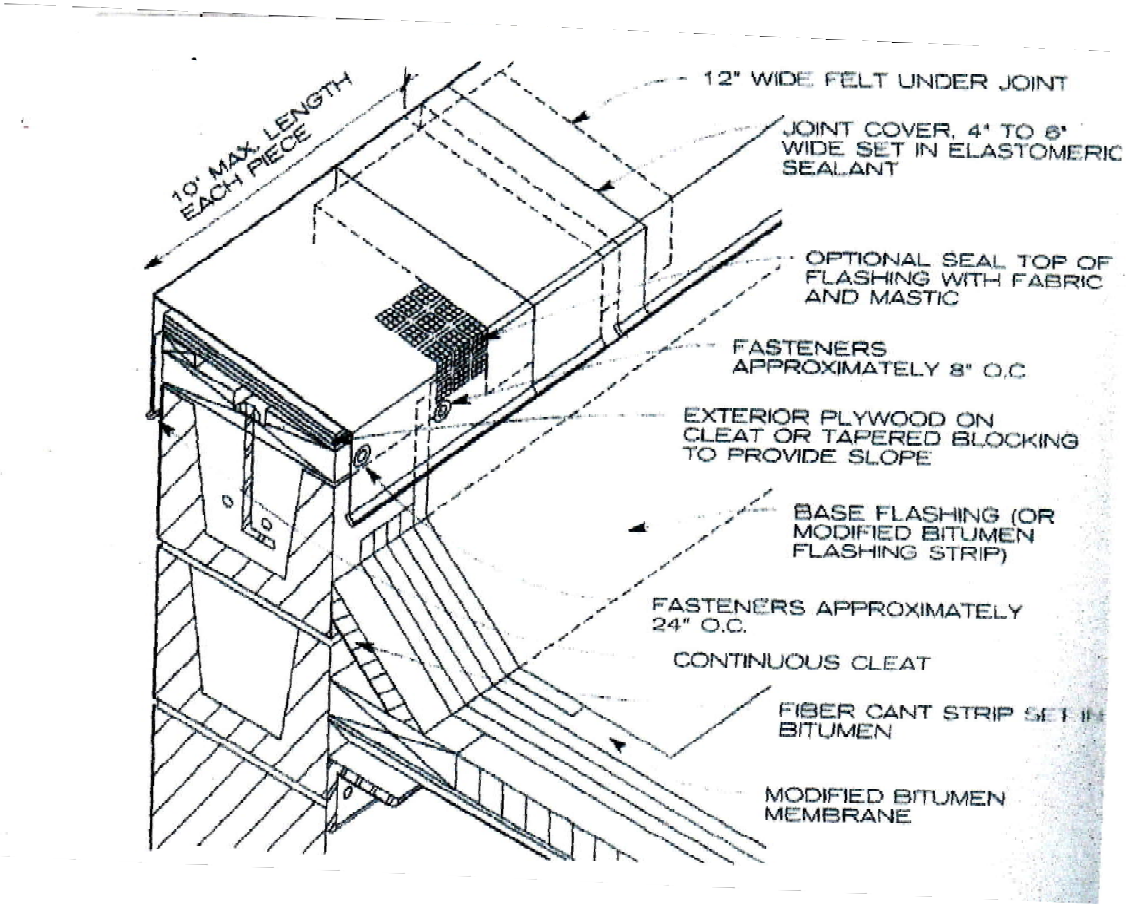
- Advanced detail for its time Orchestra Hall, HGA Architects
- Combined air and vapor barriers – multi-layered system
- Continuous insulation (Ci)



System Development

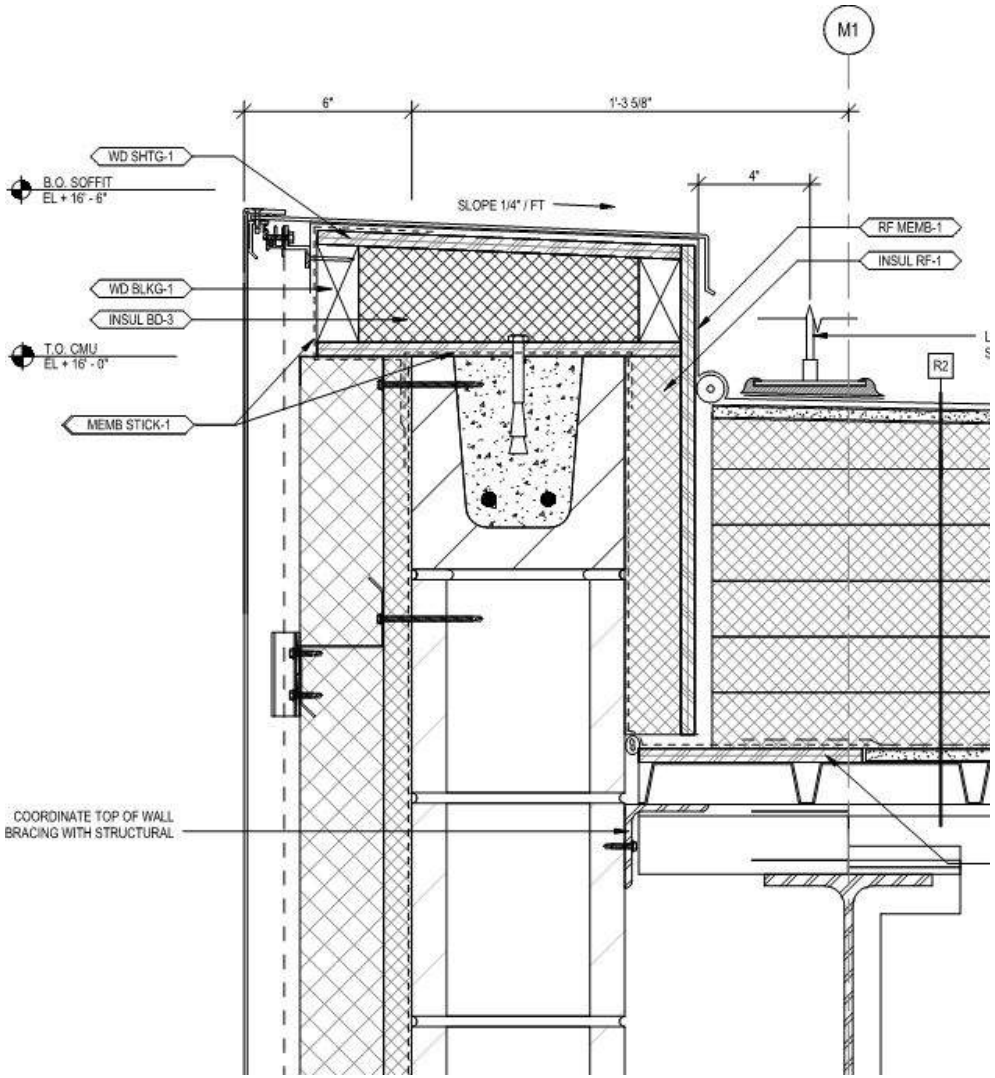
Graphic Standards, ca. 1990

- Uneven progress
- Single focus – roof membrane only
- Minimal insulation



CMU Back-up

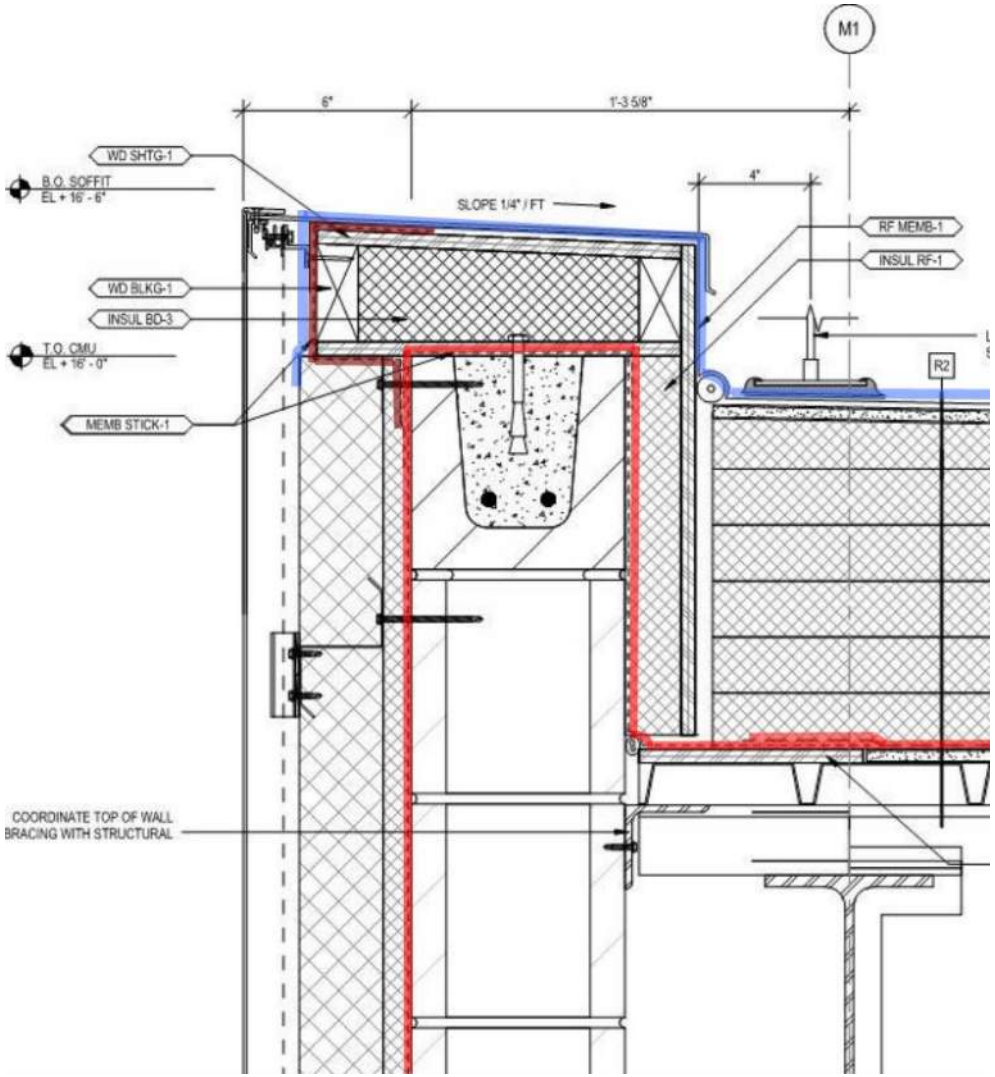
CODE COMPLIANT MASONRY PARAPET



CMU Back-up

CODE COMPLIANT MASONRY PARAPET

- Blue line keeps the water out
- Red line keeps air and vapor in
- Continuous insulation
- Transition strip for trade sequencing



Air Barriers
Energy Code Issues

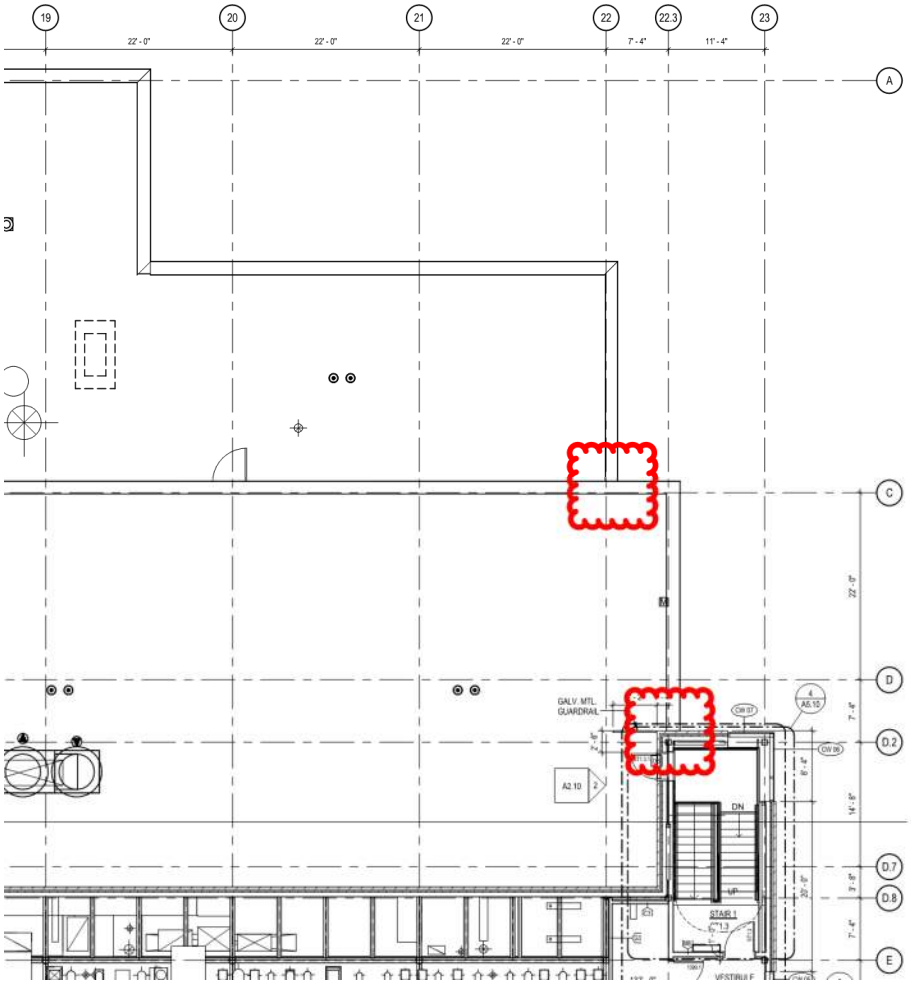
IECC and ASHRAE contain similar requirements for Air Barrier design

IECC C402.4.1 / ASHRAE 5.4.3.1 AIR BARRIER DESIGN

- A continuous air barrier shall be provided throughout the building thermal envelope. The air barriers shall be permitted to be located on the inside or outside of the building envelope, located within the assemblies composing the envelope, or any combination thereof.
- All air barrier components of each building envelope assembly *shall be clearly identified or noted on construction documents*.

IECC C402.4.1.1 / ASHRAE 5.4.3.1 AIR BARRIER INSTALLATION

- The air barrier shall be *continuous for all assemblies that are the thermal envelope of the building and across the joints and assemblies.*
- Joints around Windows and doors, junctions between walls and floors, between walls at corners, and between walls and roofs shall be sealed
- Air barrier *joints and seams shall be sealed, including sealing transitions in places and changes in materials.* Air barrier penetrations shall be sealed…

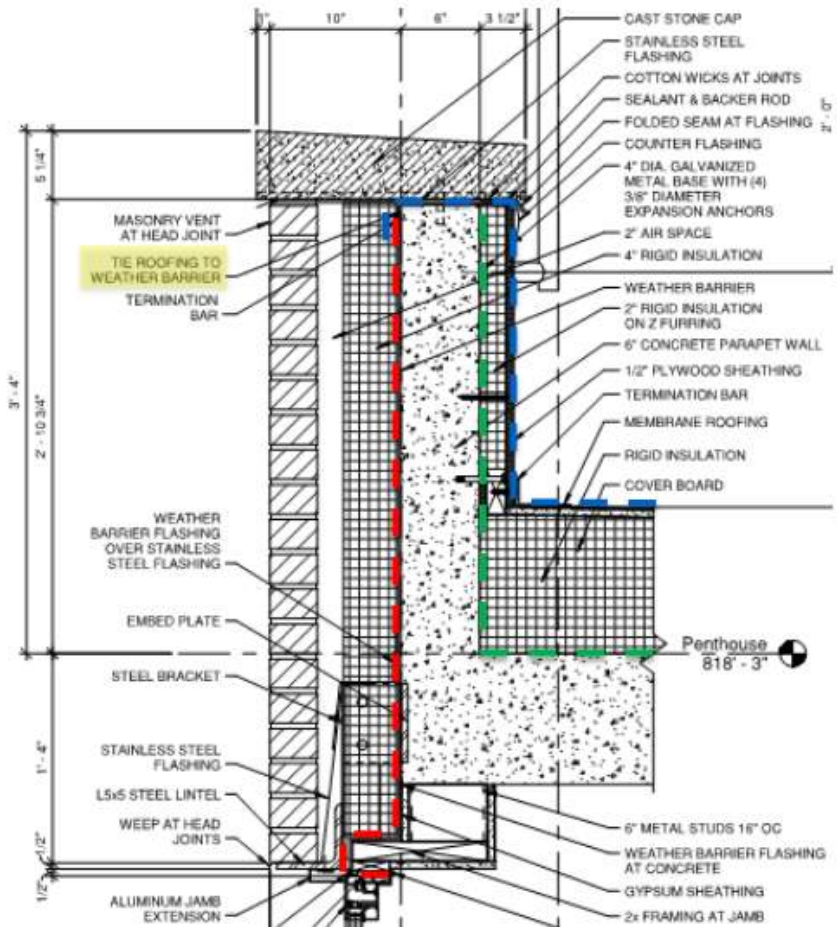


PARAPETS INTERSECTING WALLS

- This condition is often overlooked in the details
- Wall cladding may be installed before roof
- How is roofing connected to wall air barrier at intersection?

Cast Concrete Back-up

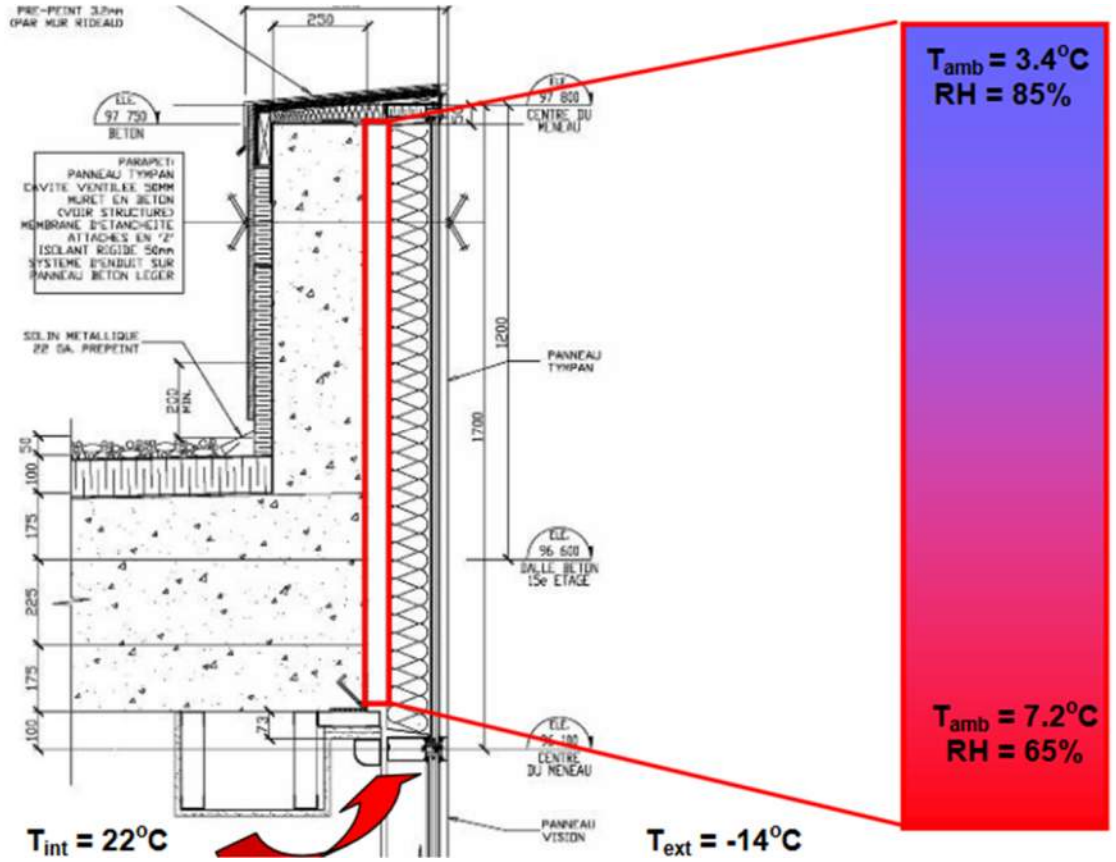
- A simpler solution – constructability and sequencing issues reduced
- Rooftop vapor barrier extends to top of wall
- Roof membrane laps over top of wall to seal to wall air barrier



Cast Concrete Back-up

CURTAIN WALL PARAPET

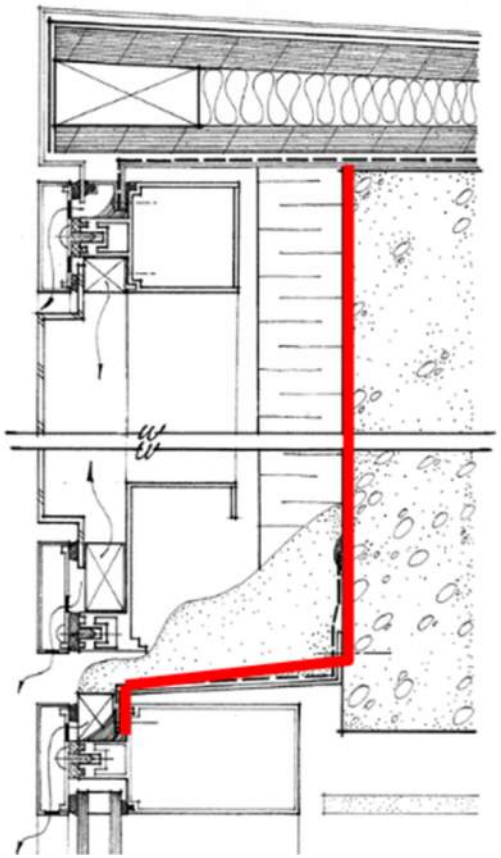
- Back pan and insulation present at curtain wall, but cavity behind is unsealed
- Concrete acts as air barrier
- Roof membrane laps over top of wall to seal to wall air barrier



Cast Concrete Back-up

CURTAIN WALL PARAPET

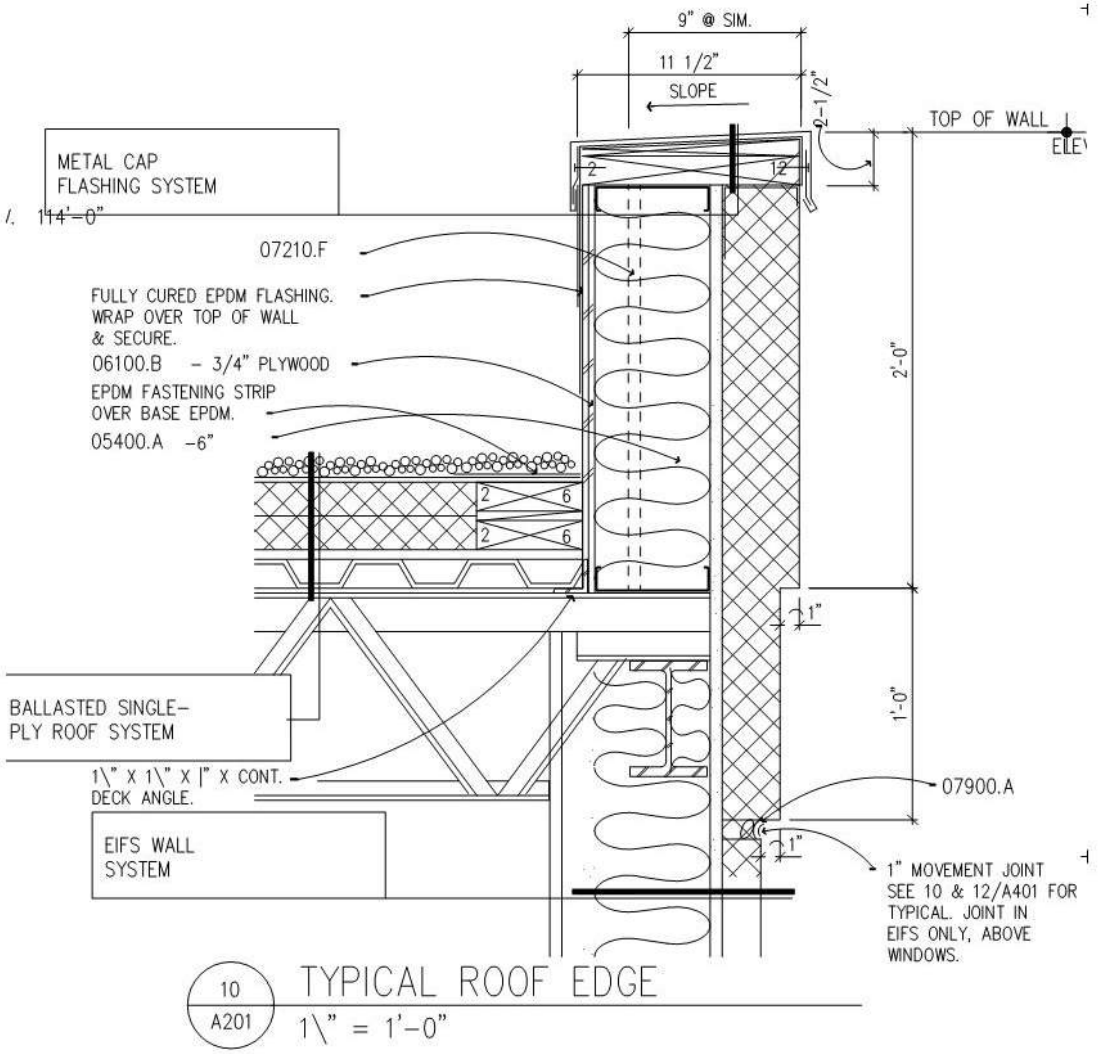
- Air barrier added behind insulation
- Roof membrane sealed into glazing pocket
- SPF and TWF at head of vision glass / slab interface



Metal framing

PLATFORM FRAMING

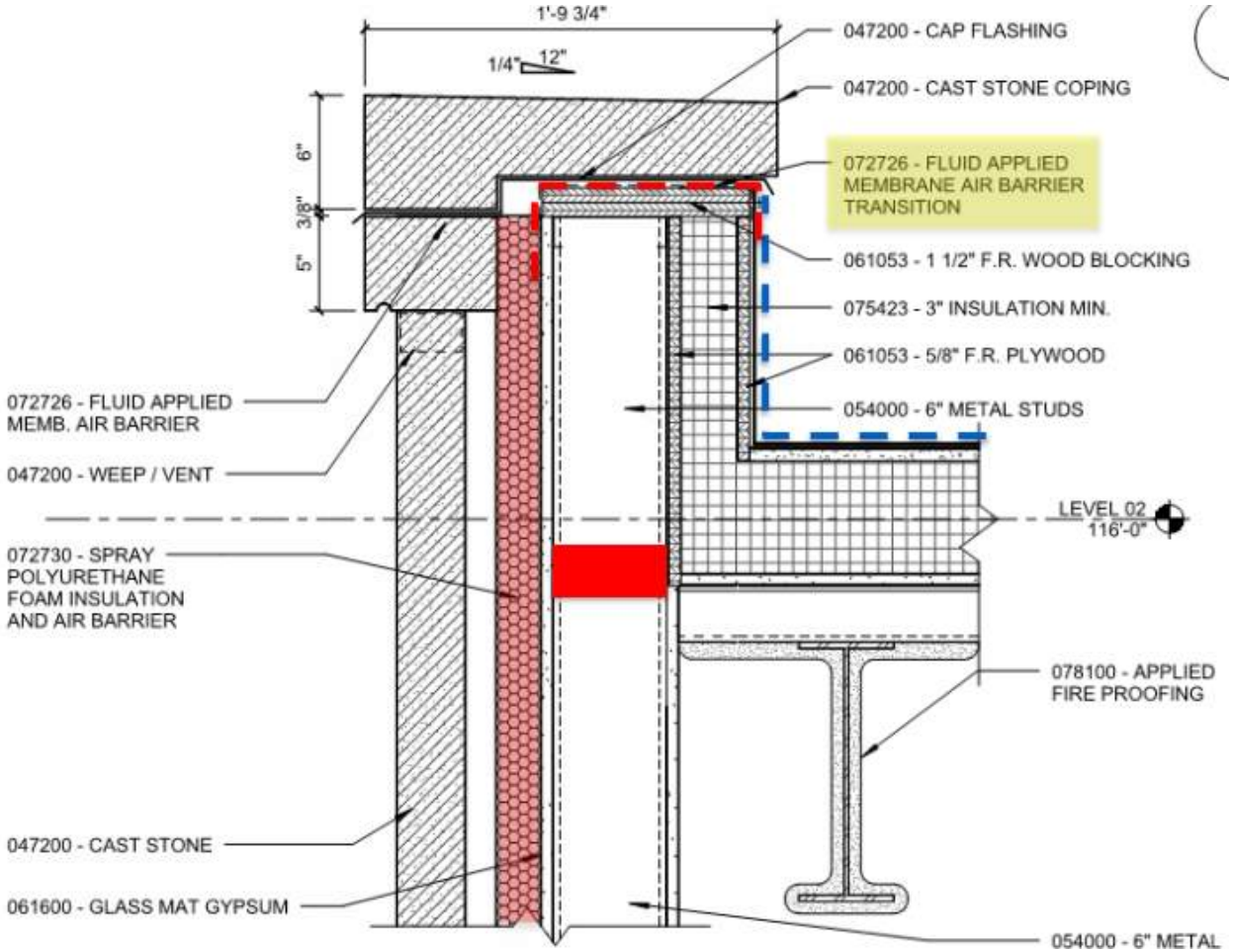
- Circa 1990
- Unacceptable lack of detail
- Ballasted roof membrane, mechanically fastened to parapet – not an effective air barrier
- No rooftop vapor barrier – condensation likely if bypasses and penetrations are not perfectly sealed



Contemporary Metal framing

BALOON FRAMING

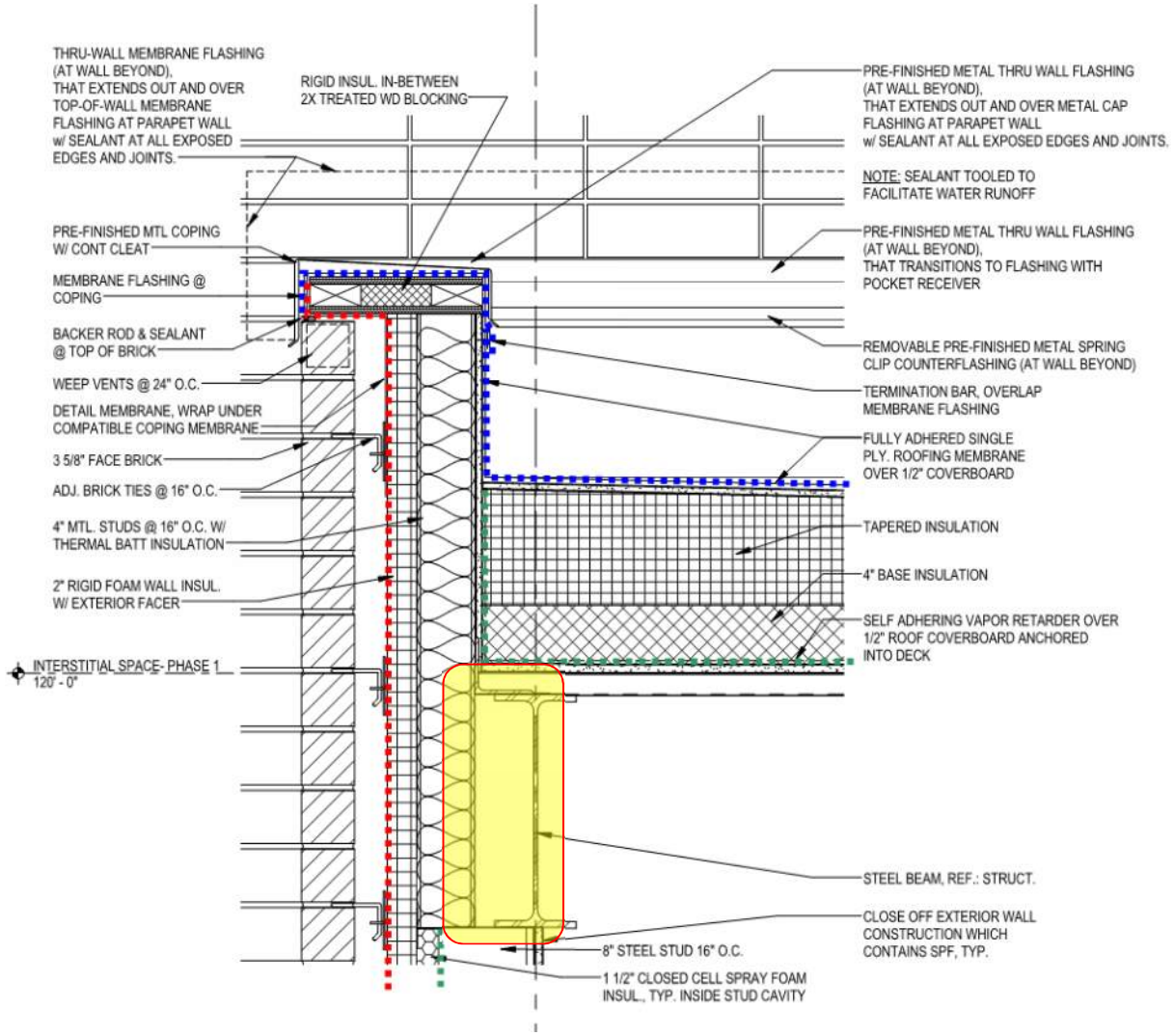
- Hardest to get right
- Transition membrane connects wall air barrier to roof membrane – roof membrane must be fully adhered to be the air barrier
- Ensure compatibility of roof and transition membrane
- **No rooftop vapor barrier shown**
- **No seal indicated in parapet stud cavities**



Contemporary Metal framing

CONTINUITY CHALLENGES

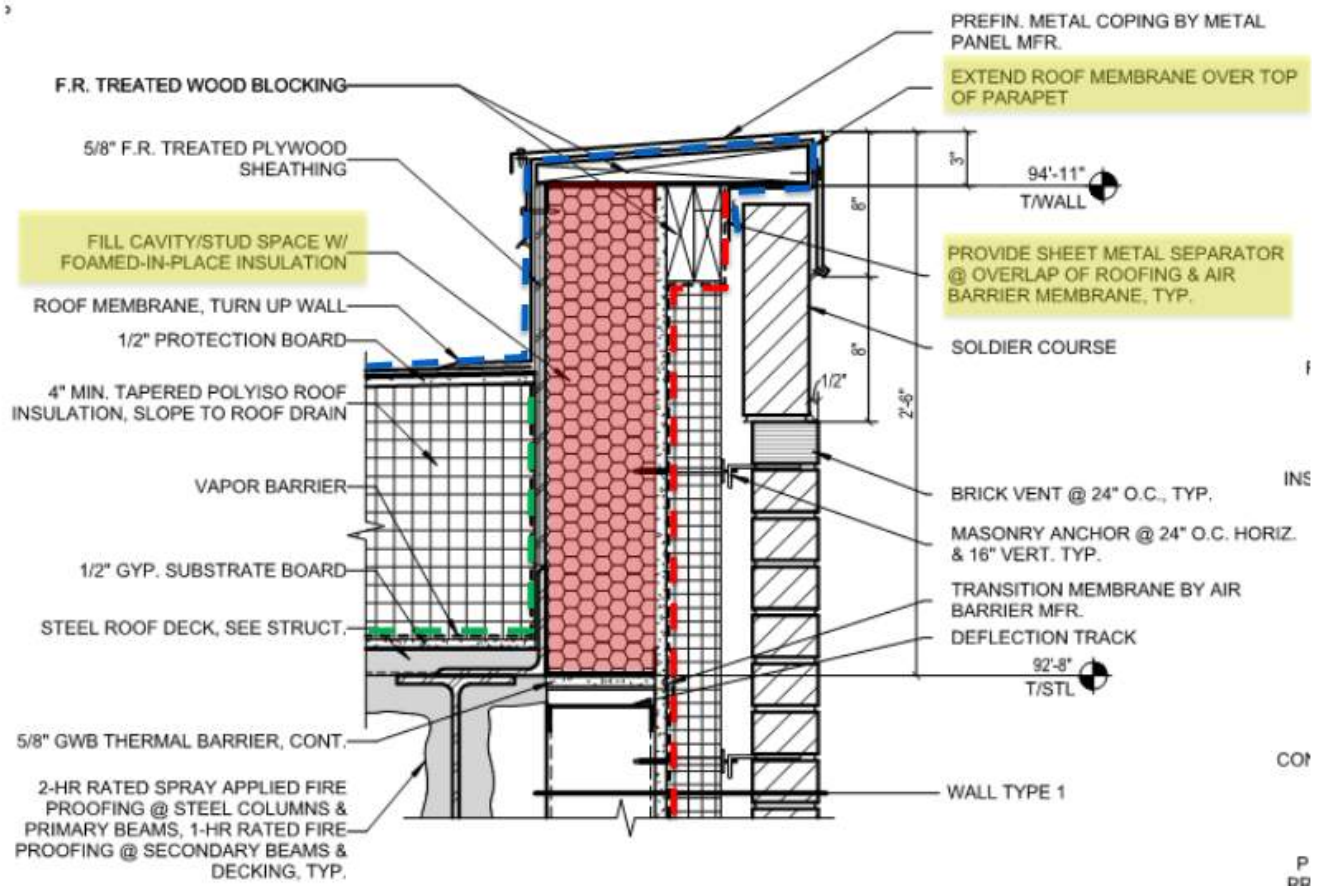
- Structural / mechanical interference creates gaps in vapor retarder
- Conditioned interior air can flow into the parapet
- Air barrier outboard of insul. (Thermax or sim).



Contemporary Metal framing

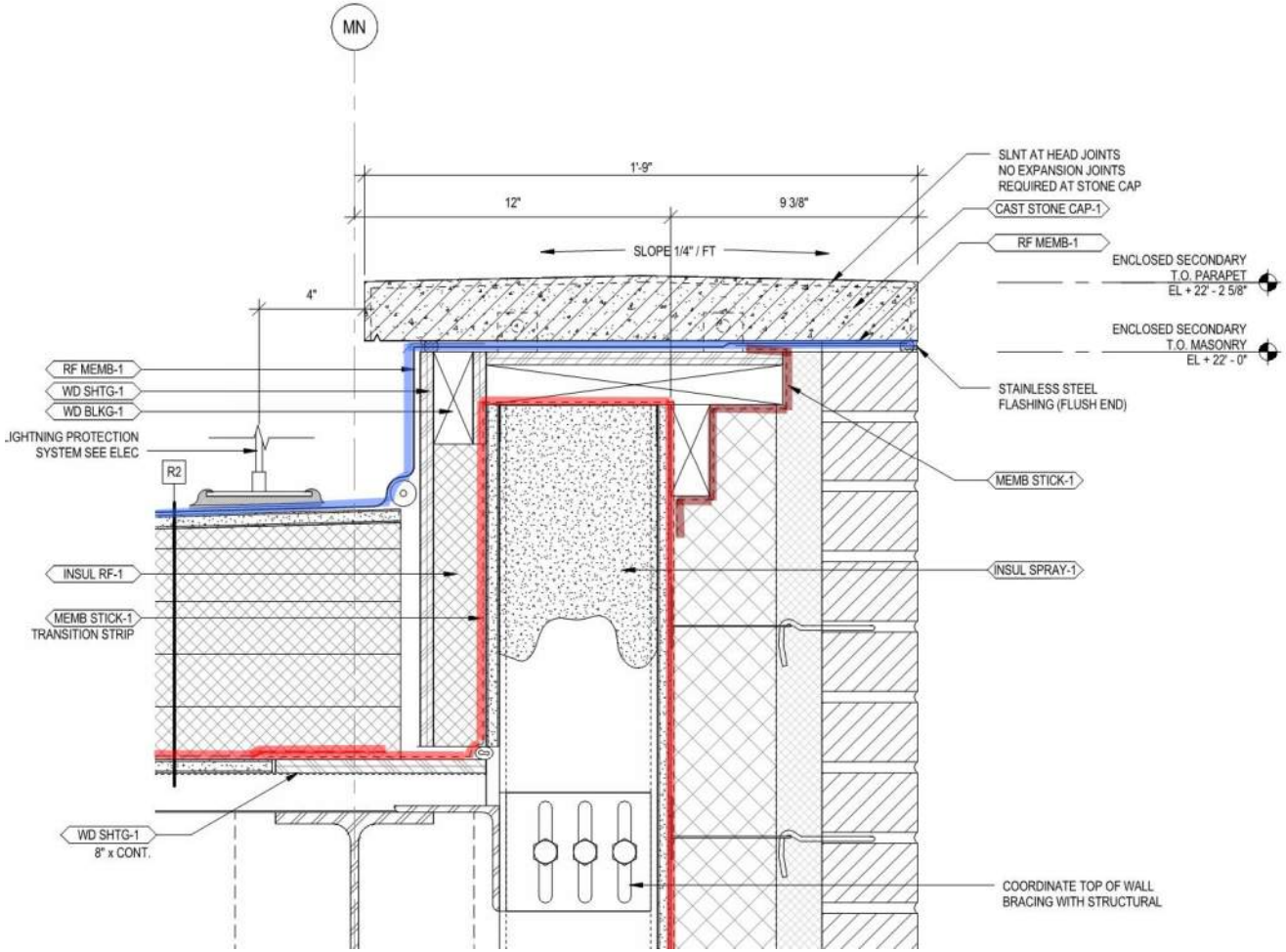
BALOON FRAMING

- A better option
- SPF connects wall air barrier to roof vapor barrier
- Constructability issue with SPF in stud cavities



Contemporary Metal framing

- Continuous insulation
- Continuous air & vapor barriers
- Allows for deflection
- Wood sheathing transition strip



Case Study Details

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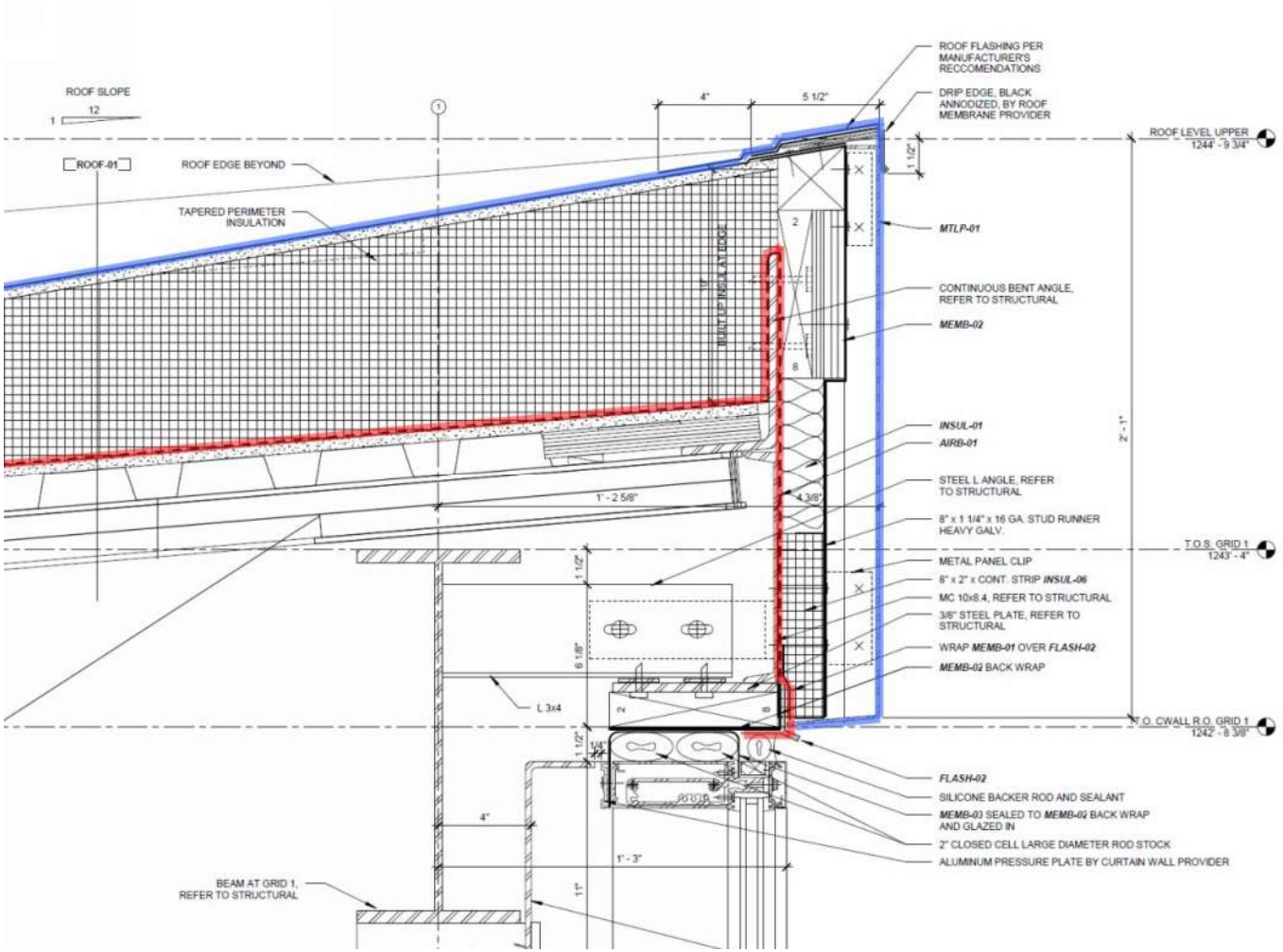

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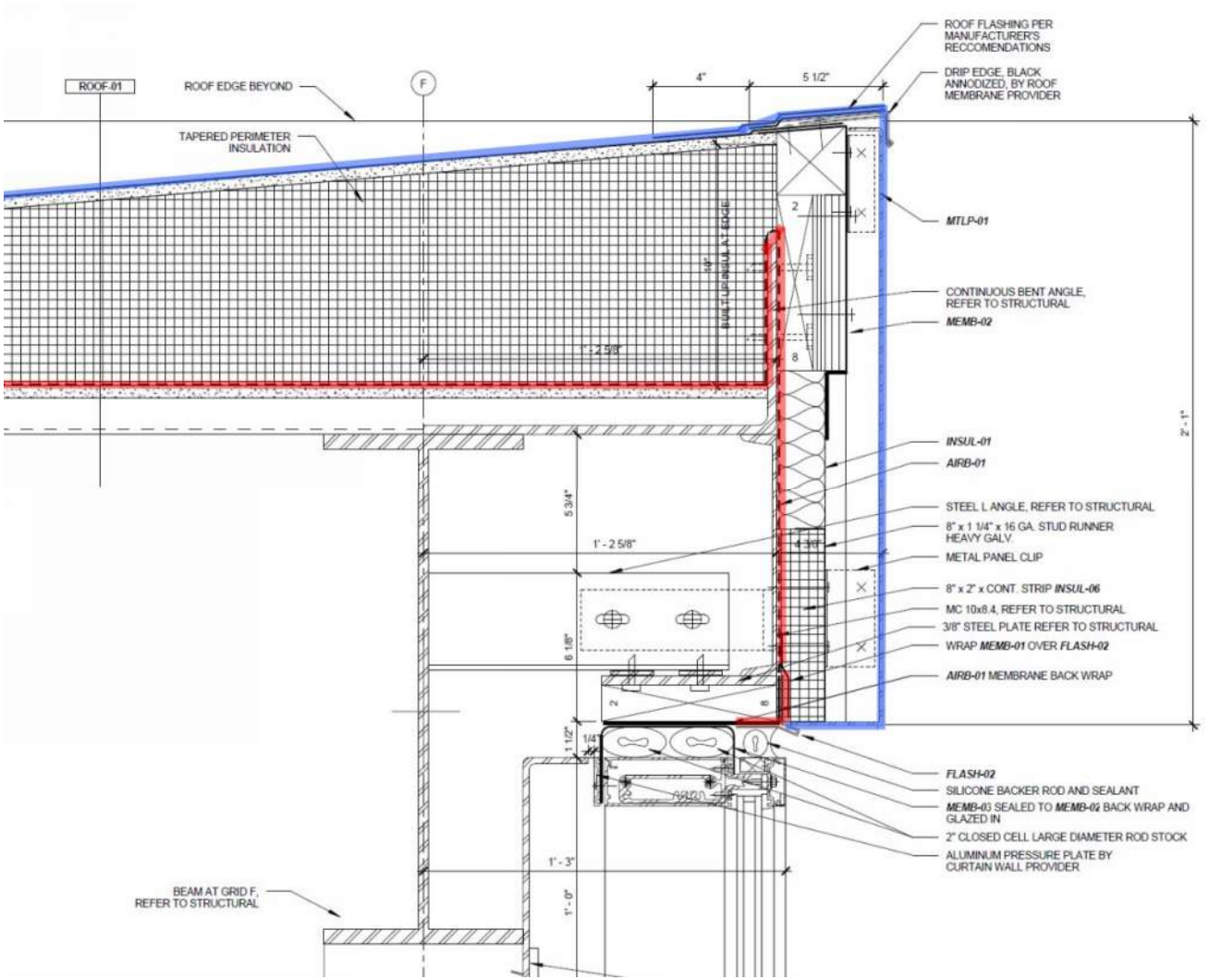
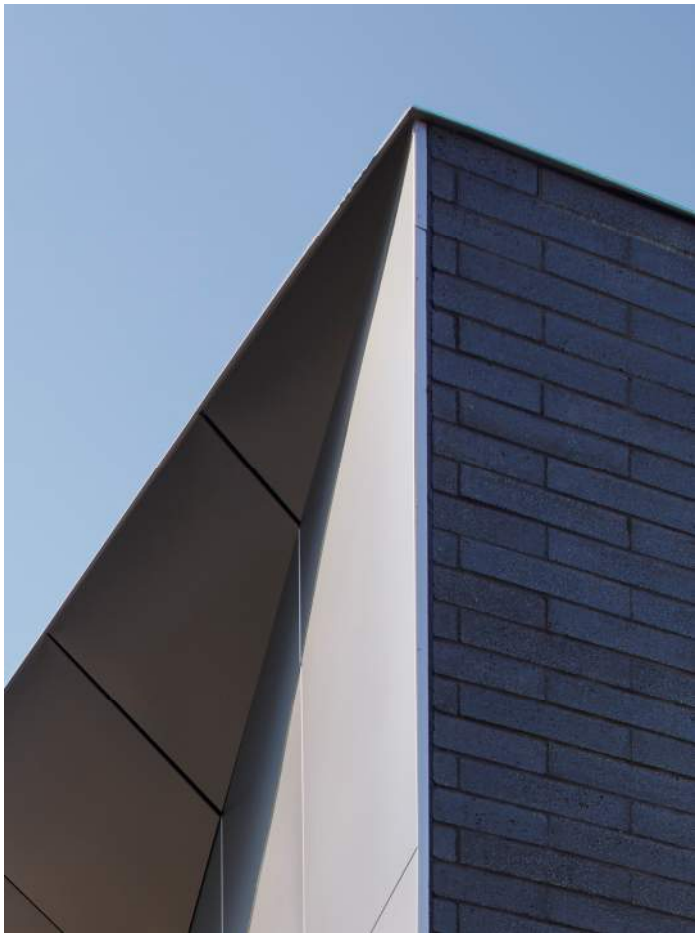
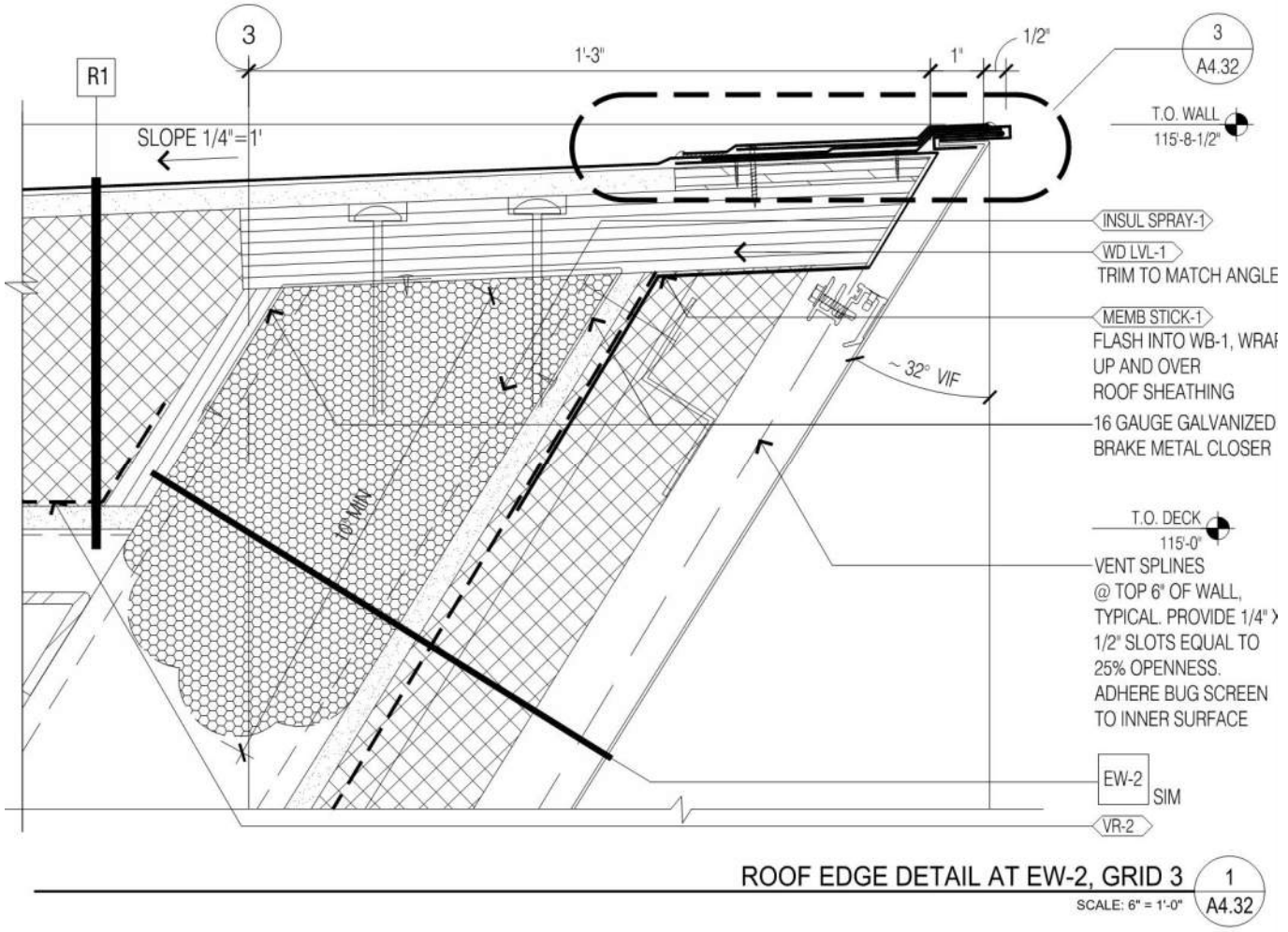


Case Study Details

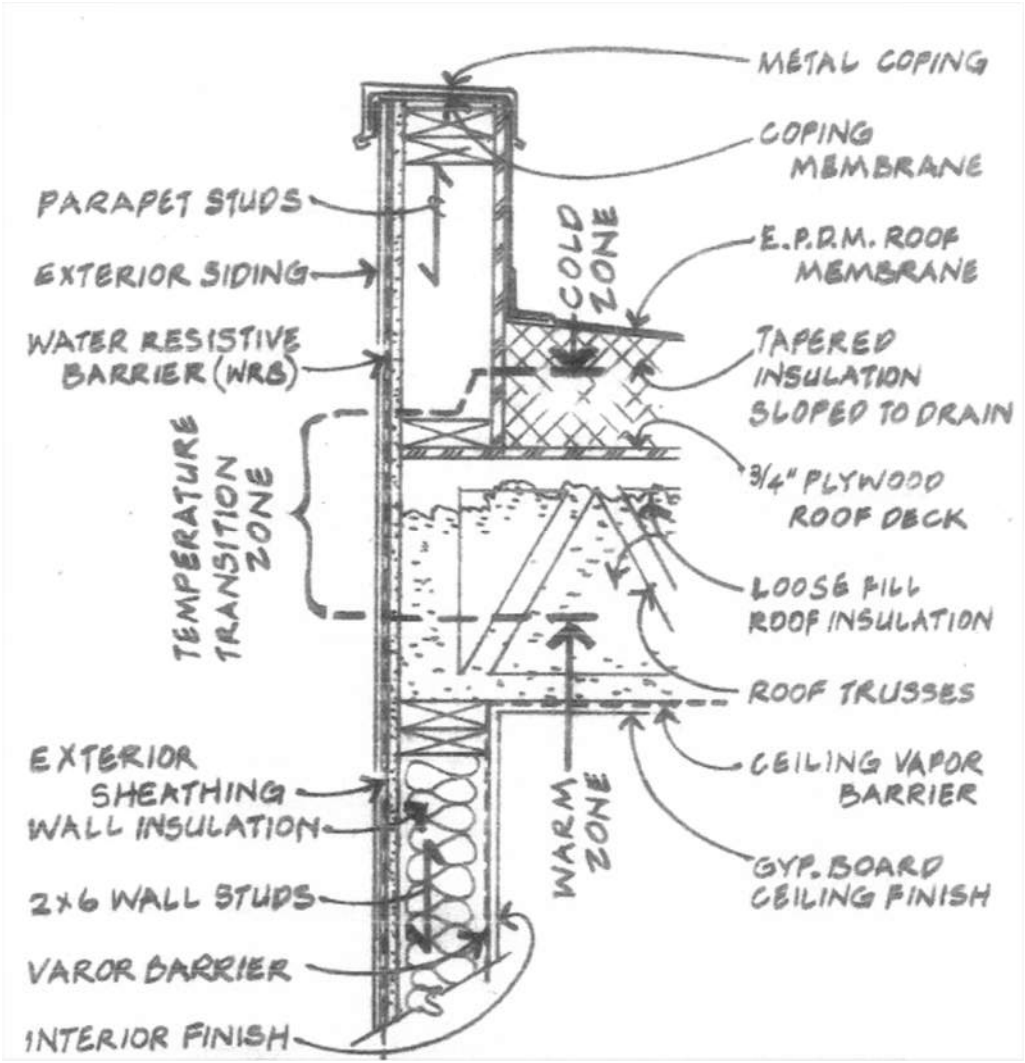


Case Study Details



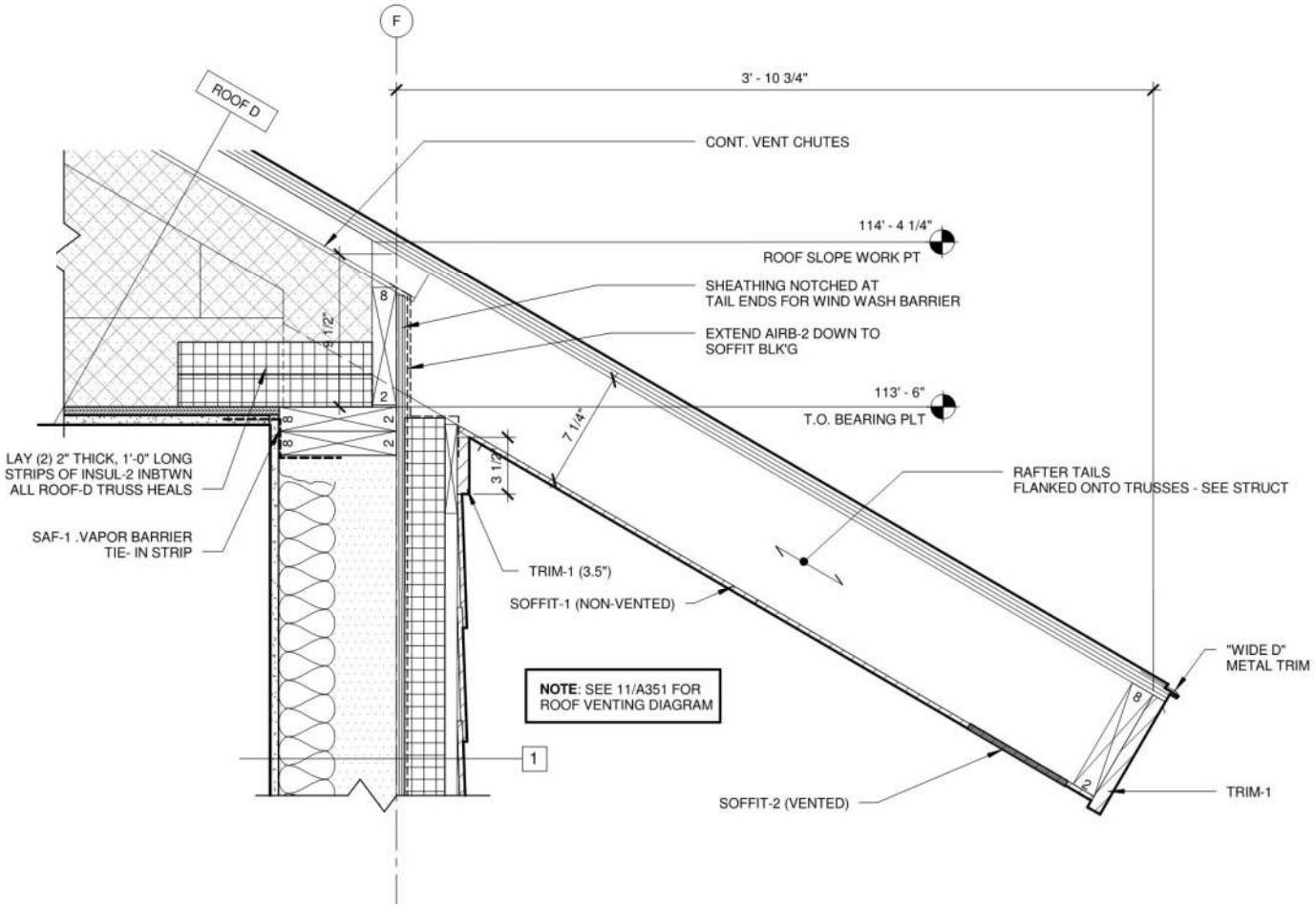
Wood Framing

Wood parapet diagram



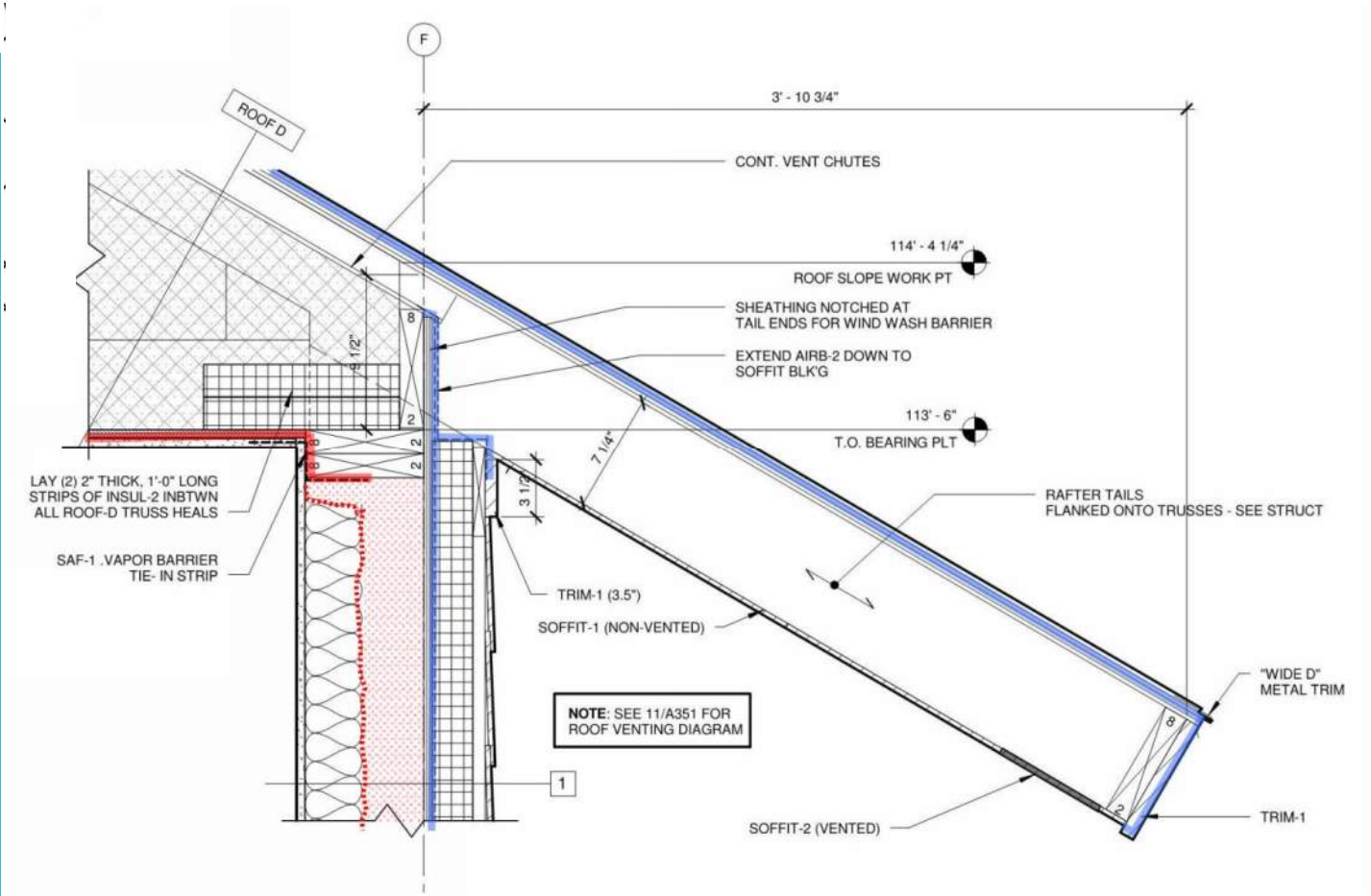
Contemporary Wood Framing

Wood Wall / Roof Interface with Roof Trusses



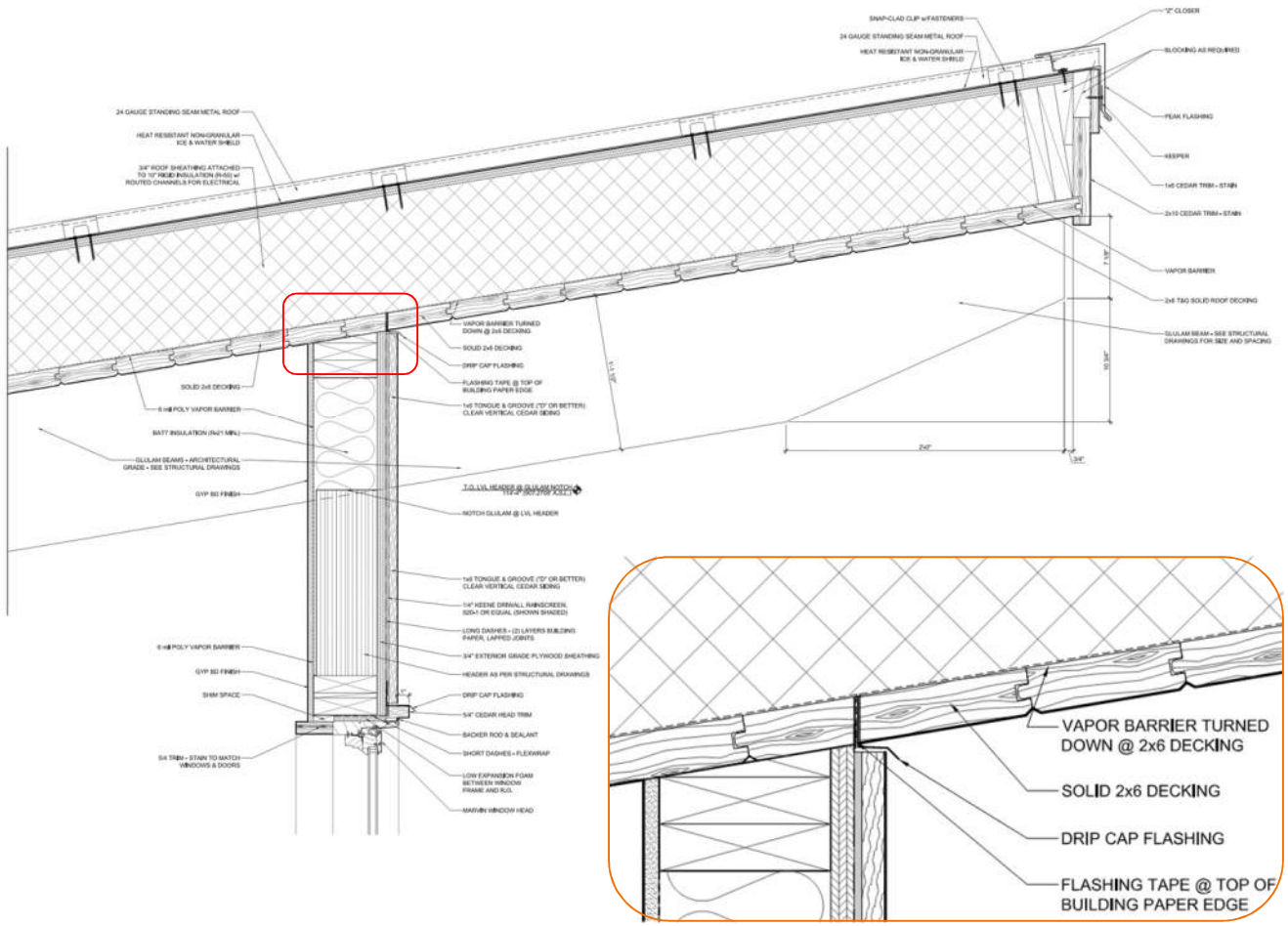
Contemporary Wood Framing

Wood Wall / Roof Interface with Roof Trusses



Contemporary Wood Framing

Wood Wall / Roof Interface with Structural Wood Deck



Building Enclosure Council

BEC MINNESOTA

Questions?
Comments?

…join us next month!

BEC-MINNESOTA *https://bec-mn.org*

Interdisciplinary non-profit organization of architects, engineers, consultants, manufacturers, contractors, building officials, developers, owners, facility managers, educators, students, and other interested individuals with a common interest in promoting high-performing building enclosures. Our purpose is to:

- Promote and conduct discussion, training, education, technology transfer, research, and the exchange of information about all matters concerning the building enclosure and the related science;
- Initiate and promote dialogue between professions and among researchers, government, designers, manufacturers, suppliers, fabricators, contractors, building operators, developers, insurers, and others with an interest in the building enclosure; and
- Facilitate improvements in process, inspection, commissioning, approvals, codes, regulations, standards, quality control, liability matters, and the like for matters that affect the building enclosure.
- Monthly Meetings, May through September