

Construction Manager/ Subcontractor/Tradesperson Training Session 1: **Introduction & Building Envelope**

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Our services include:

- Energy Conservation and Management
- Sustainability Consulting
- Green Building Certification
- Accessibility Consulting

We have over 125 staff across three office locations:
New York, NY | Washington, DC | Norwalk, CT

For more information, visit
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Upon Completion of Module

You will receive the following items via email:

- AIA Certificate of completion-can also be used for:
  - NYS PE CEUs
- PDF of final presentation
- Link to the webinar recording



Steven Winter Associates, Inc.
Improving the Built Environment Since 1972

Provider #: J827

CONTINUING EDUCATION AIA

CERTIFICATE OF COMPLETION

THIS CERTIFICATE IS TO CERTIFY THAT
Katie Zoppo

PARTICIPATED IN
Module 1: Overview of PH/Net Zero Building Concepts, Techniques and Benefits

COURSE NUMBER
M1OOPHNZBCTAB

ON
February 11th, 2020

LOCATION
New Paltz, NY

EARNING
4 AIA CES Learning Unit/HSW

Lois B. Arena, PE
Director, Passive House Services
Steven Winter Associates, Inc.

Steven Winter Associates, Inc.
61 Washington Street
Norwalk, CT 06854
203.857.0200
larena@swinter.com

Learning Objectives



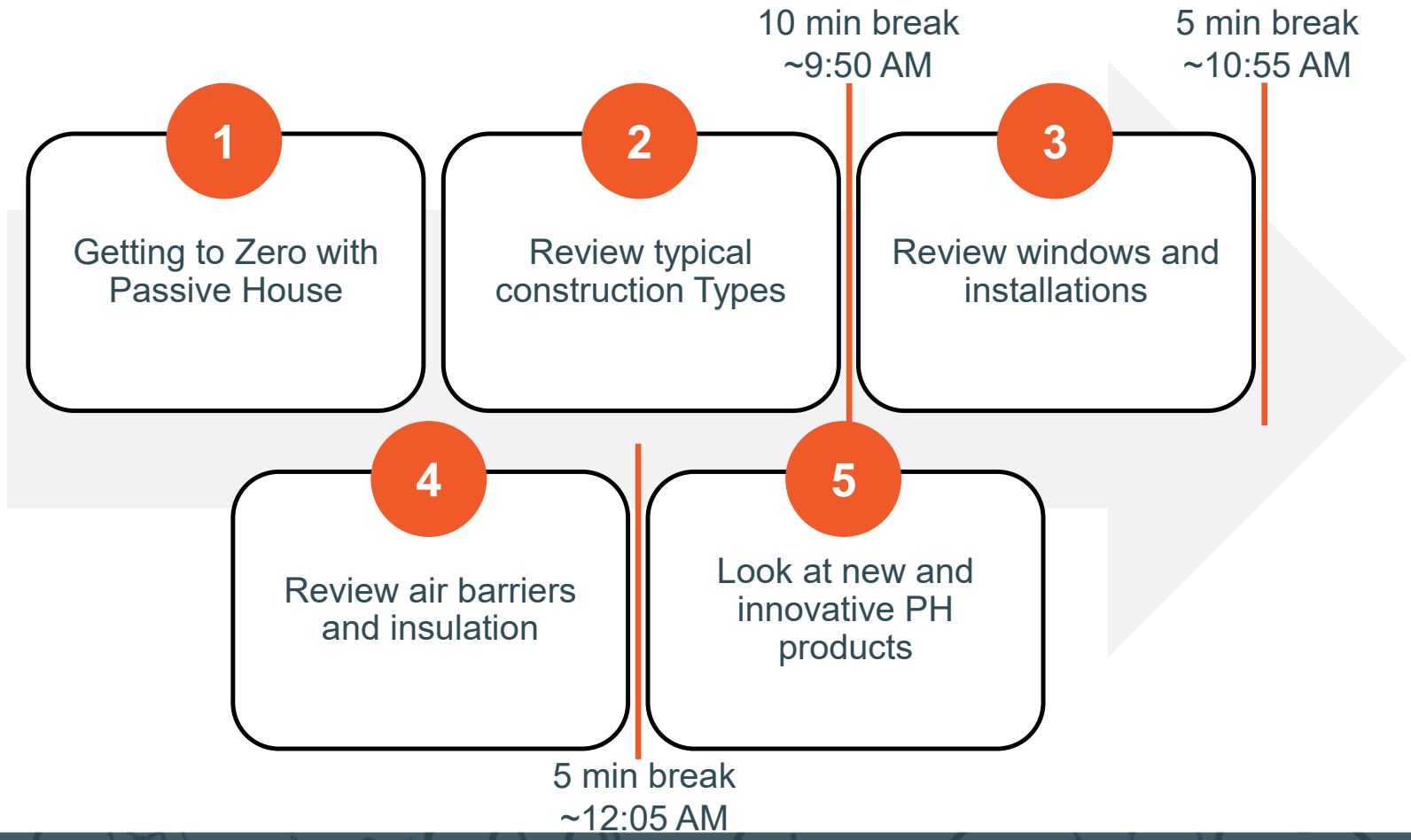
Understand net zero carbon goals for SUNY

Discuss typical construction types and sample details

Review high performance windows and installations

Examine installed air barriers and insulation photos of good vs bad examples

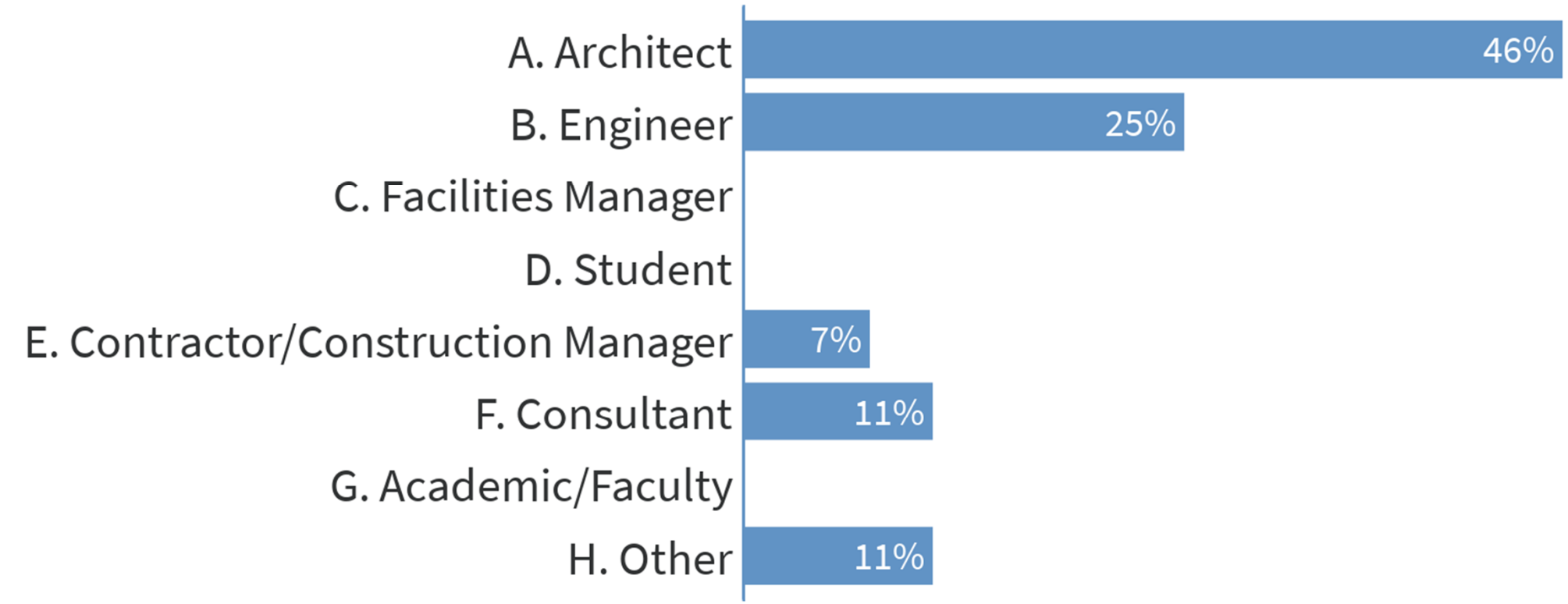
Overview of Presentation



When poll is active, respond at **PollEv.com/swa335**

Text **SWA335** to **22333** once to join

What is your profession?



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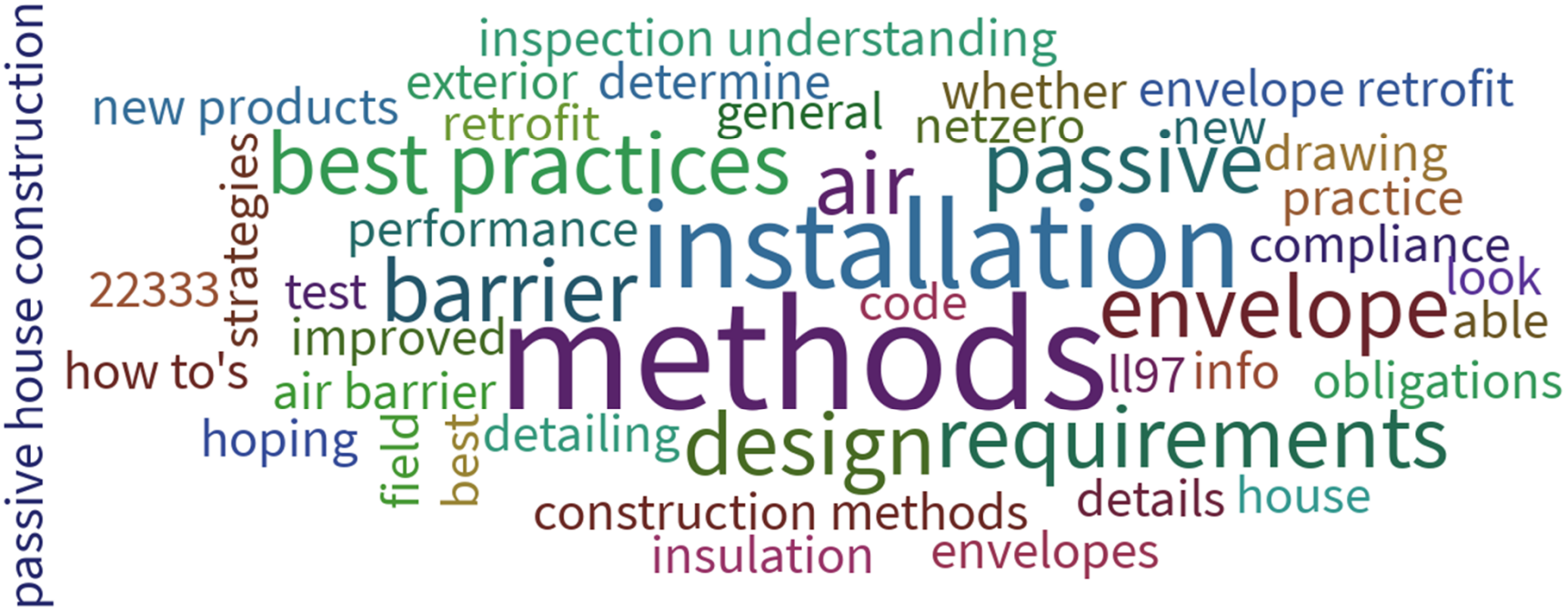
What is the one thing you were hoping to learn about today?





Coykendall Science Building

Why we are here: **Directive 1B-2**

- 2018 Chancellor calls for all new buildings to be zero-net-carbon & deep energy retrofits for existing buildings
- 2018 SUCF issued Directive 1B-2
  - Purpose: define and identify goals for Net Zero Carbon (NZC) new buildings and Deep Energy Retrofits (DER) of existing buildings.
  - Function: outlines the project target goals and provides direction for project designs.
  - Metrics: Site Energy as the measure of performance and energy consumption.

Why we are here: **Directive 1B-2**

- Design and construct highly energy efficient buildings which significantly reduce energy consumed below an energy code standard for new buildings or energy usage for an existing building.
- In the case of insufficient project funding, the design goal will be to design the building as NZC “capable” where: the design achieves the energy use intensity (EUI) limit using HVAC equipment and systems that can be electrically powered from renewable energy sources.

New Building Performance goals:
Site Energy Use Intensity (EUI) limits

Classroom building	50 kBTU/ft2/year
Office building	50 kBTU/ft2/year
Laboratory building	150 kBTU/ft2/year
Residence Hall	32 kBTU/ft2/year

These **Trainings**

- **Module 1:** Overview of PH and Net Zero
- **Module 2:** Construction Methods and High-Performance Products and Details
- **Module 3:** Air Barrier Development & Implementation
- **Module 4:** Net Zero HVAC Strategies and Controls + DHW
- **Module 5**: Construction Documents and Bidding
- **Module 6**: Deep Energy Retrofits
- **Module 7**: Refrigerant Management in Design, Construction, and Operations
- **Module 8.1:** Building Envelope
- **Module 8.2:** Net Zero Mechanical, Electrical, and Plumbing
- **Module 8.3:** QA/QC Techniques for Ensuring Success
- **Module 8.4:** Field Training & Mock-Up

Clarifications

We may use Passive House and Net-Zero interchangeably

Passive House principles are a great pathway to achieving Net-Zero

Getting to Zero with Passive House

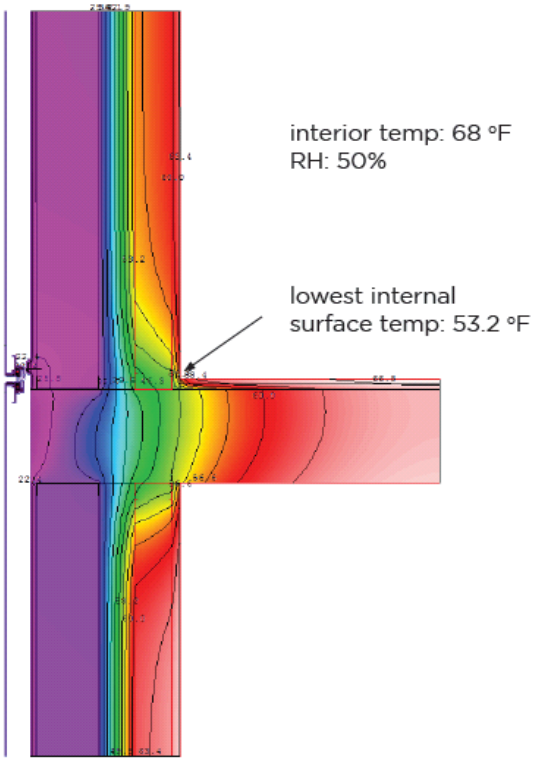
What is Passive House (PH)?

- PH is a building standard
- Applies to new & existing buildings
- The most rigorous energy efficiency certification available
- Performance-based approach
- Attention to insulation continuity and reduction of thermal bridges
- Emphasis on balanced ventilation

Goals of PH

- Building durability
- Energy $ reduction
- Optimal thermal comfort
- Superior indoor air quality
- Carbon emissions reductions





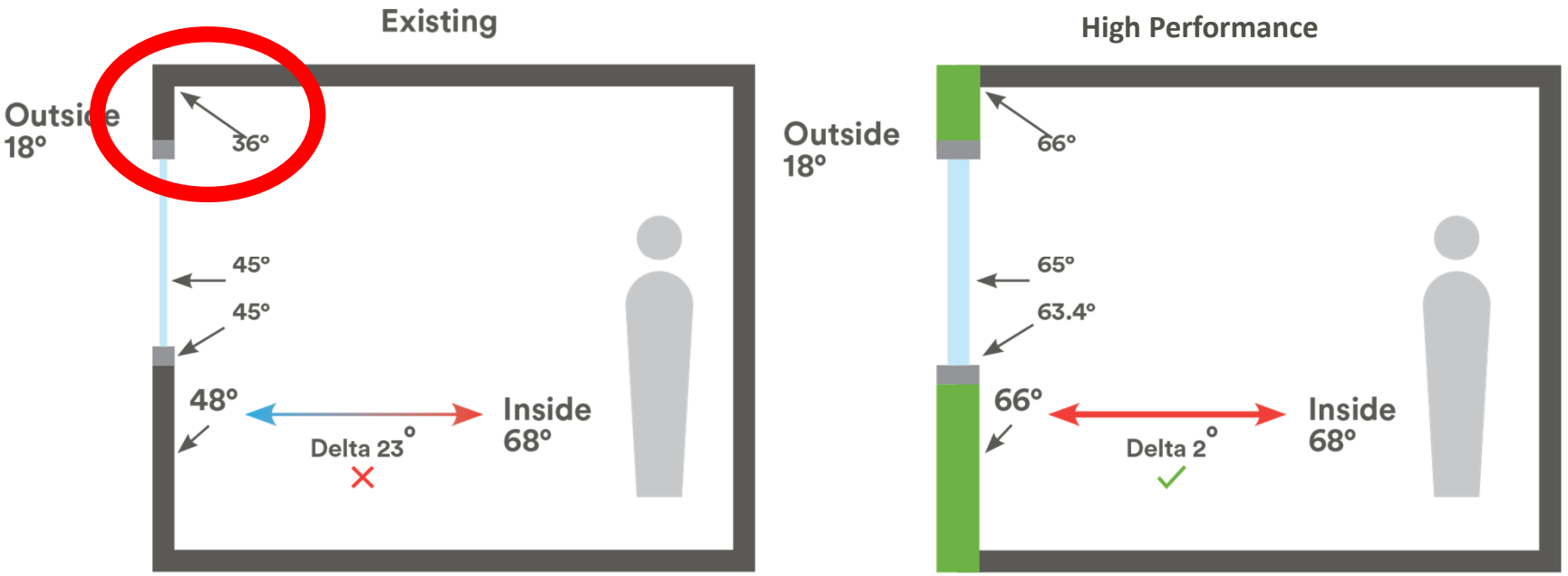
A-11 Option 2
At risk for condensation

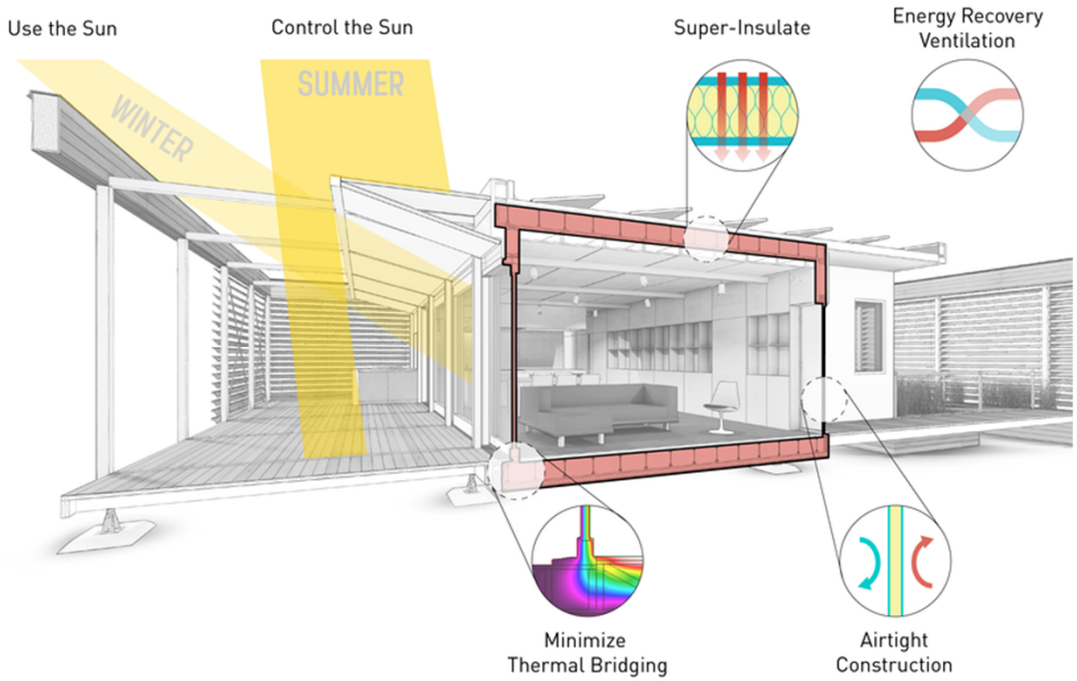
Comfort Criteria

- Interior surface temperatures should not deviate by more than 7.6°F from the average operative temperature on the inside;
- the surface temperature must not be lower than 55.4°F or greater than 132°F at any point;
- the surface temperature of the floor must be between 66°F and 81°F.

Comfort

Thermal Comfort and Interior Temperatures





The SURE House

Winner of the 2015 D.O.E. Solar Decathlon

www.surehouse.org

Passive House Principals

- Thermal insulation continuity
- Thermal bridge free construction
- Solar control
- Airtightness
- Balanced mechanical ventilation







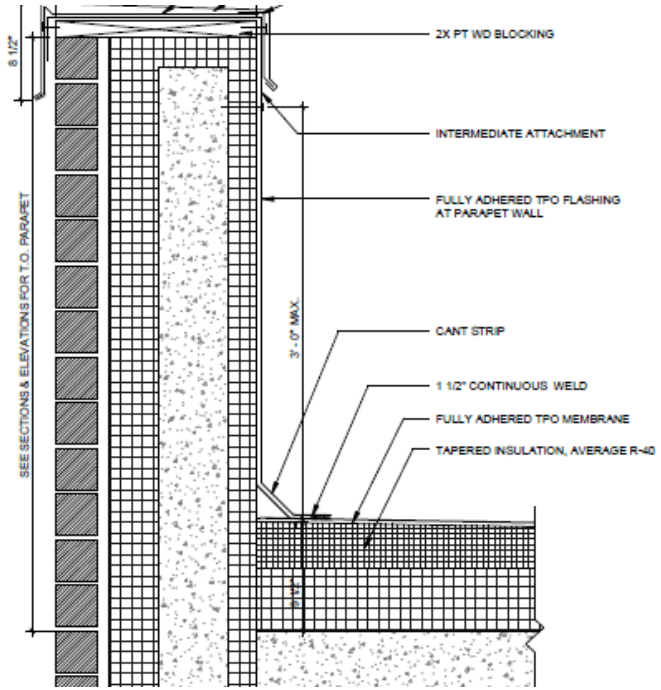


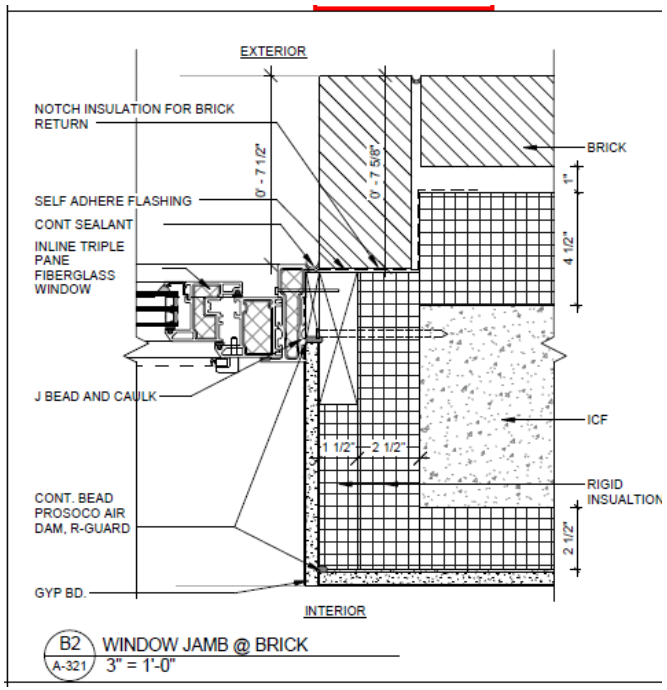






Continuous Insulation



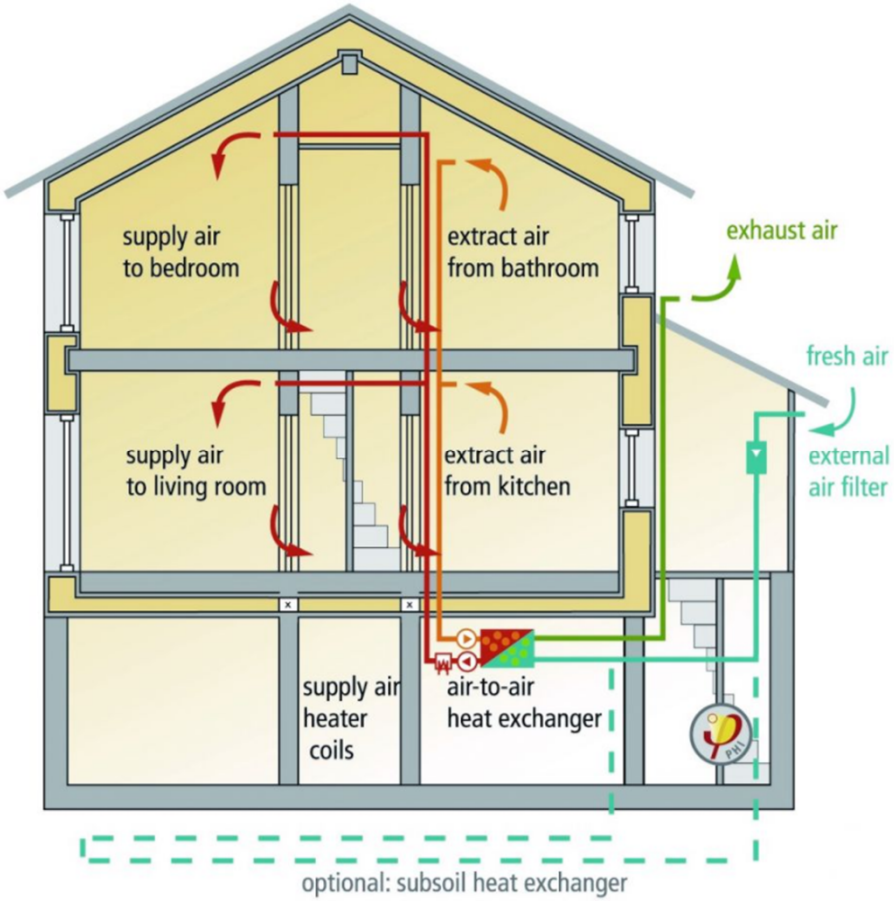




Air-Tightness Blower Door Testing

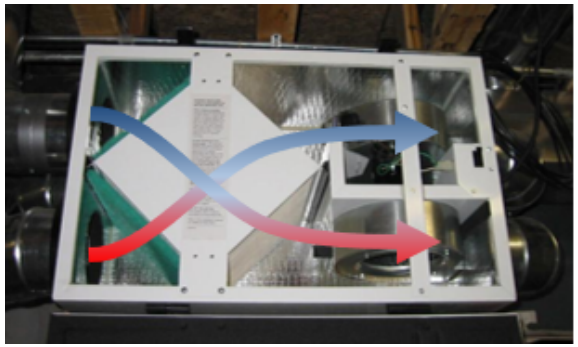
- Basic Components
  - Gauge (manometer)
  - Shroud
  - Frame
  - Fan





Balanced Ventilation and Heat/Energy Recovery

- Provide fresh, filtered air 24 hours a day
- Heat exchanger +75% Efficient
- Highly insulated and air-sealed ductwork



Questions?



Typical Construction Types - Details

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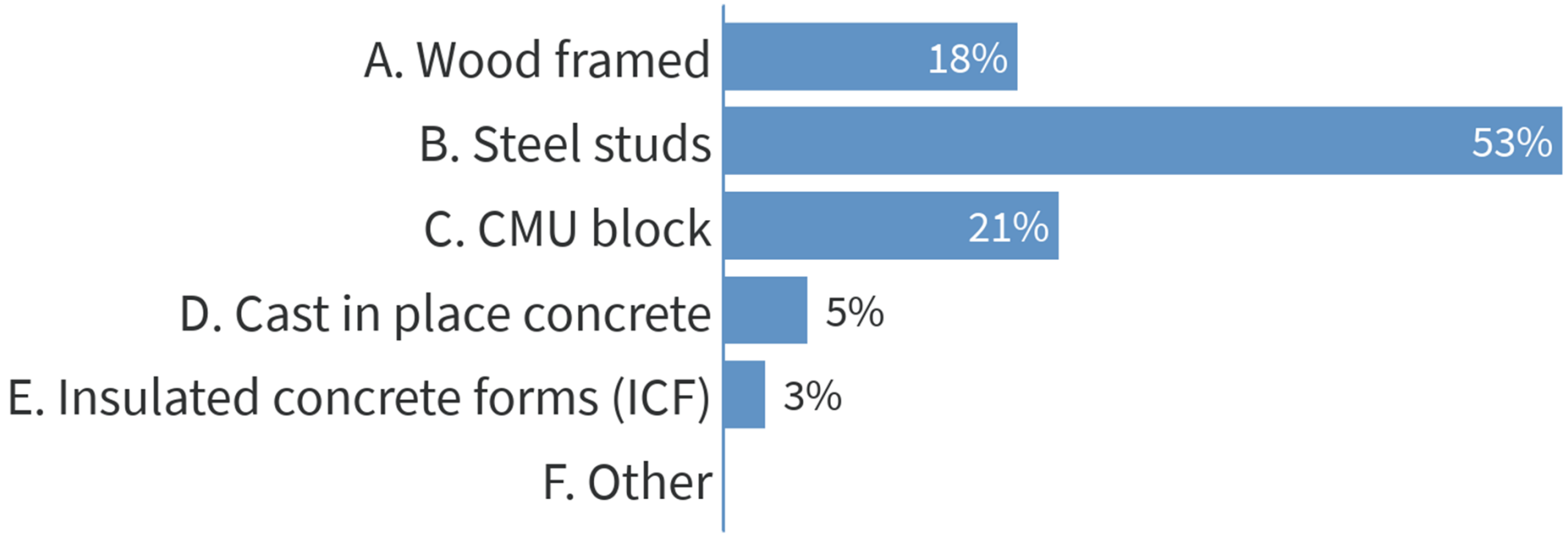
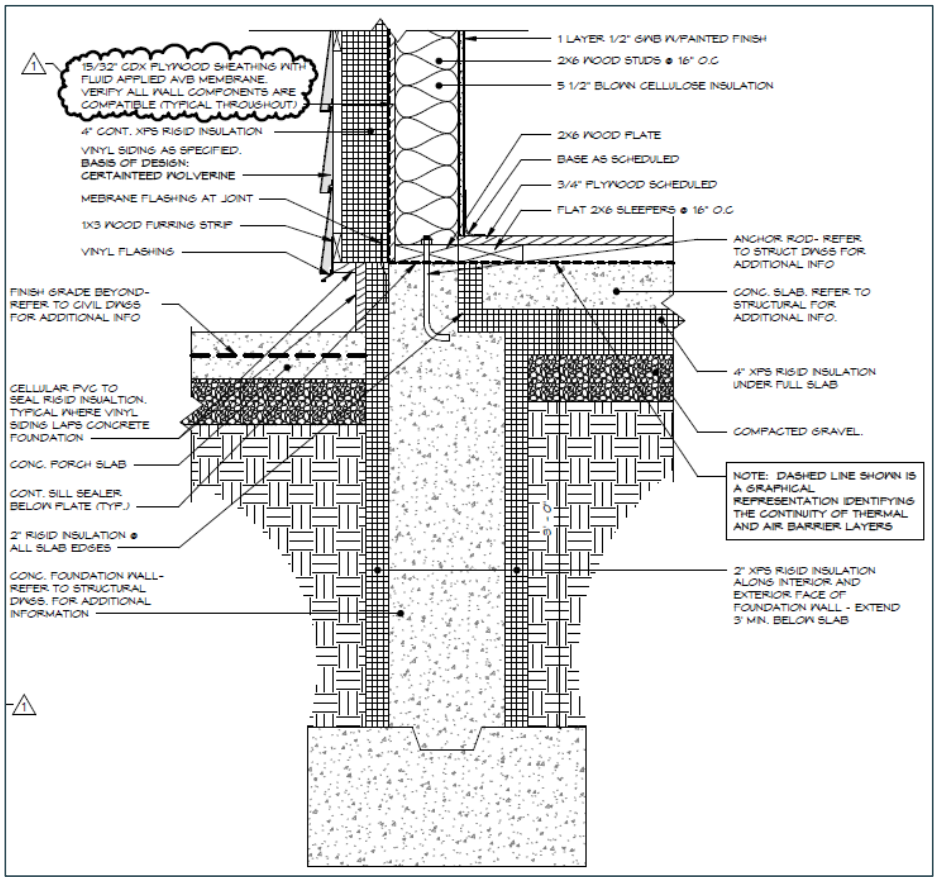
What construction type do you most commonly see on your projects?



Typical Construction Types – **Wood Framed**





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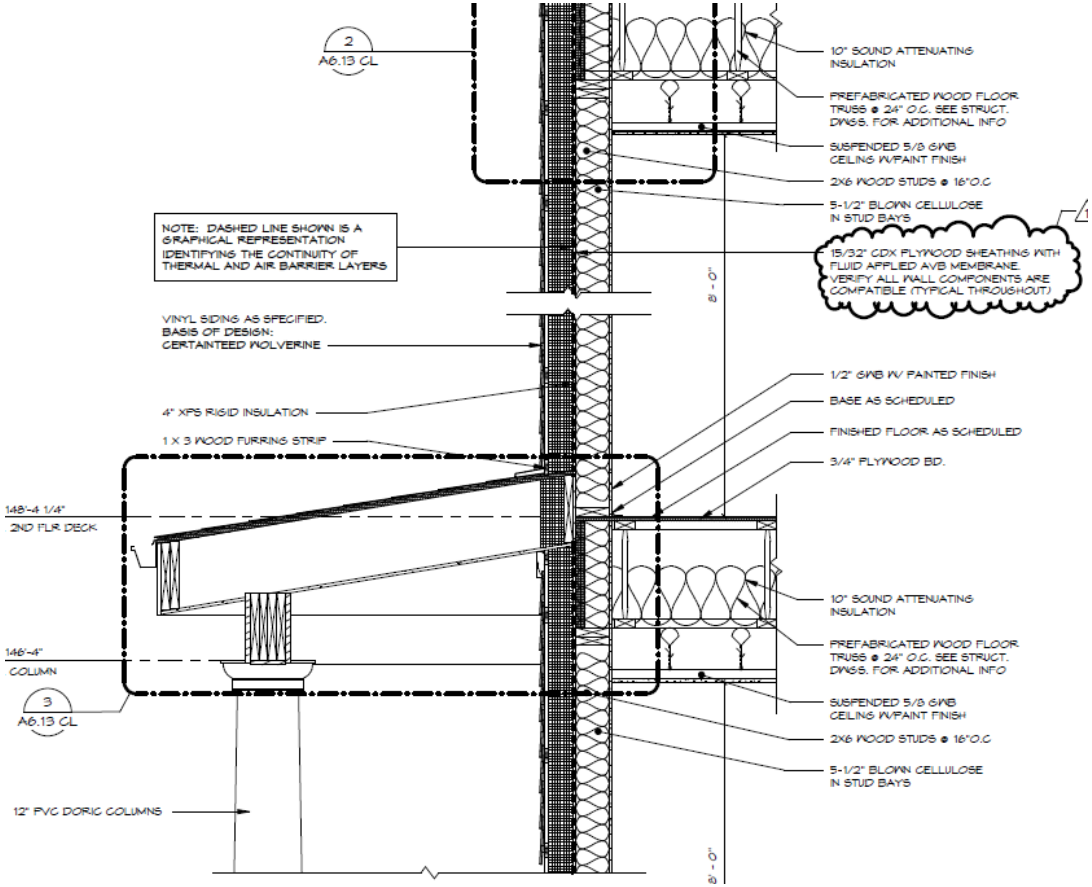



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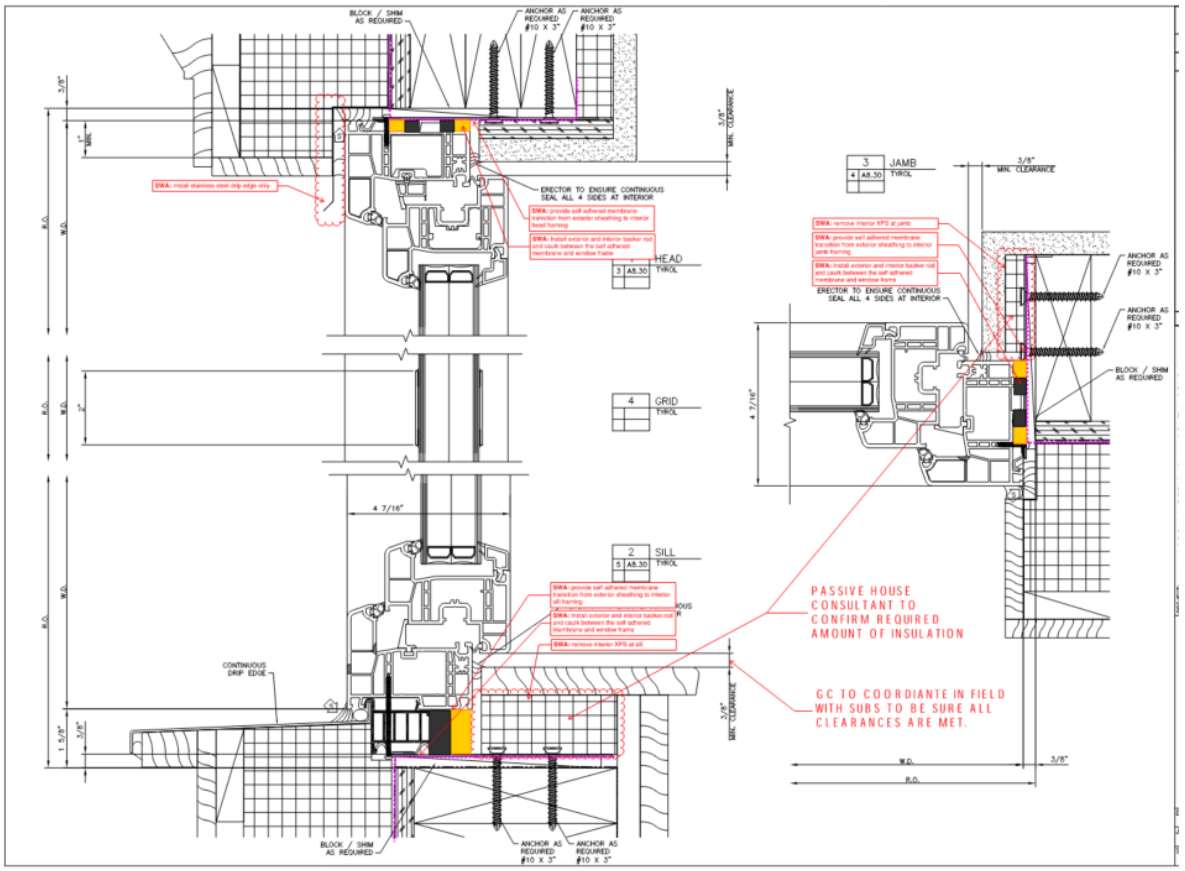



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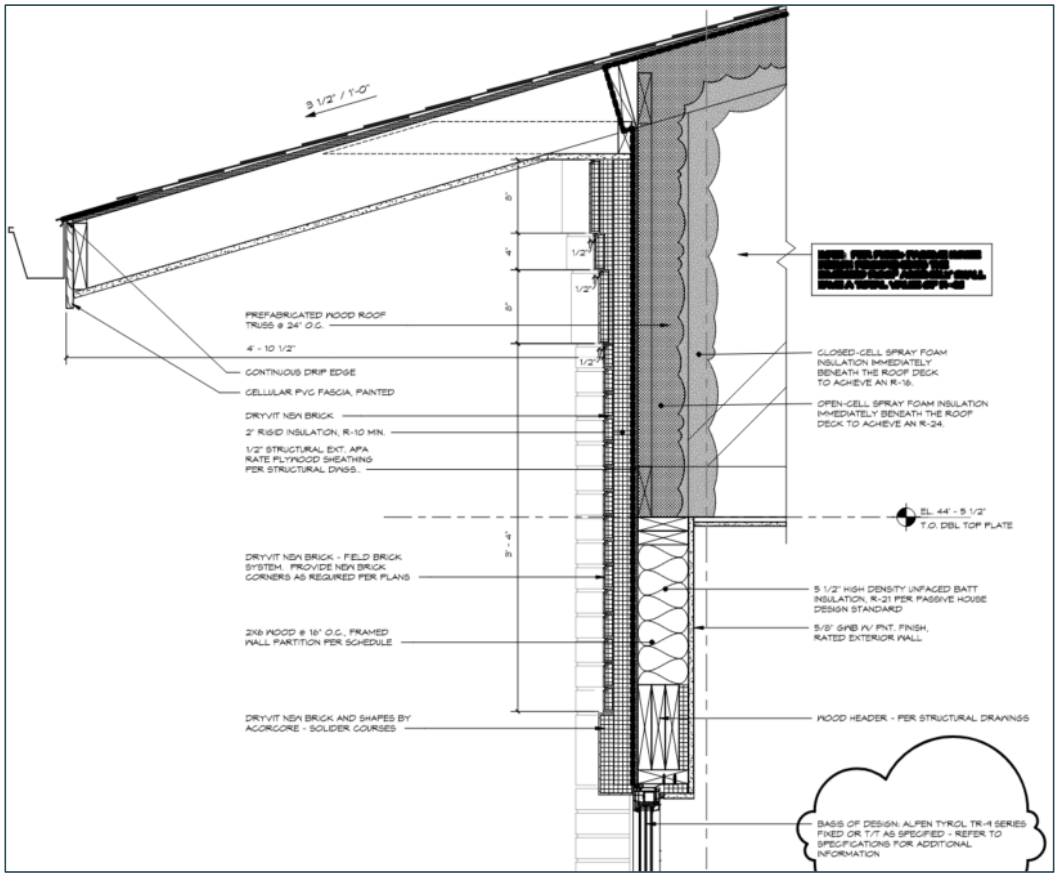
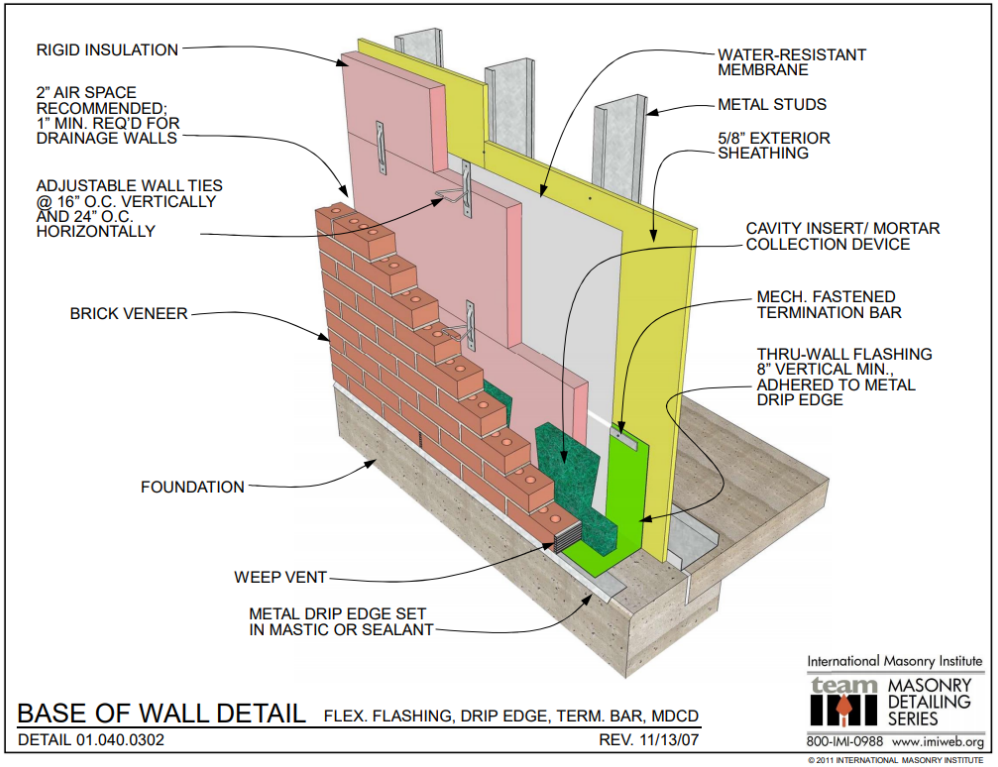
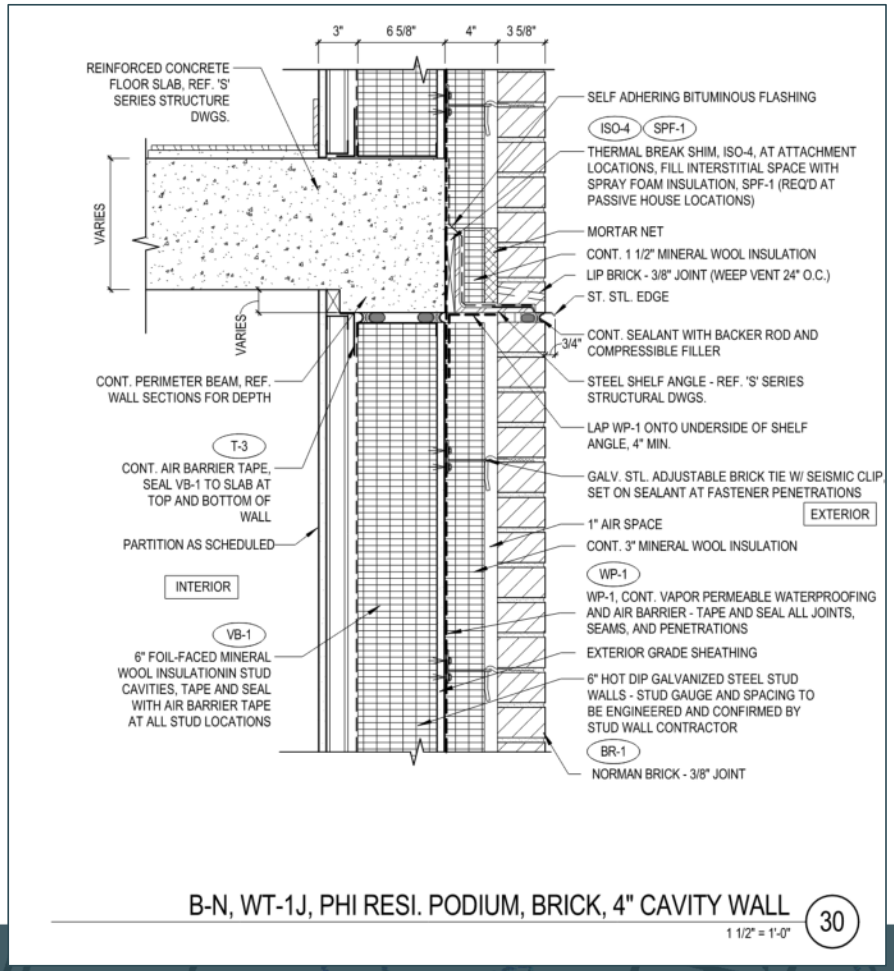


Typical Construction Types – **Steel Studs**

- Despite steel studs thermally conductive properties, they are still used on some high-performance buildings
- Steel studs are a back up wall alternative to CMU in large buildings
- It is possible to reach Passive House insulation levels with steel studs

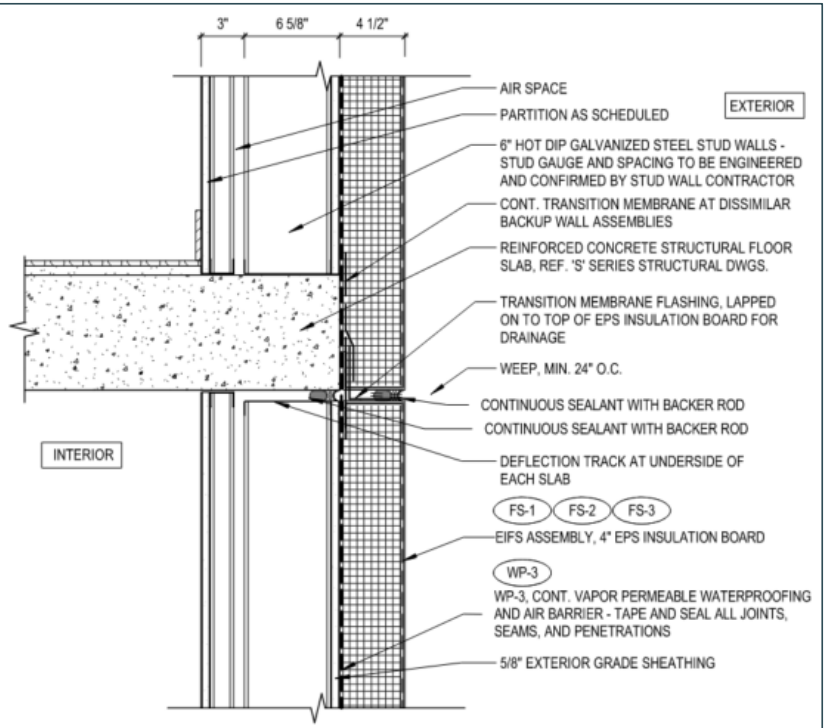


Typical Construction Types – **Steel Studs**



B-N, WT-1J, PHI RESI. PODIUM, BRICK, 4" CAVITY WALL 30

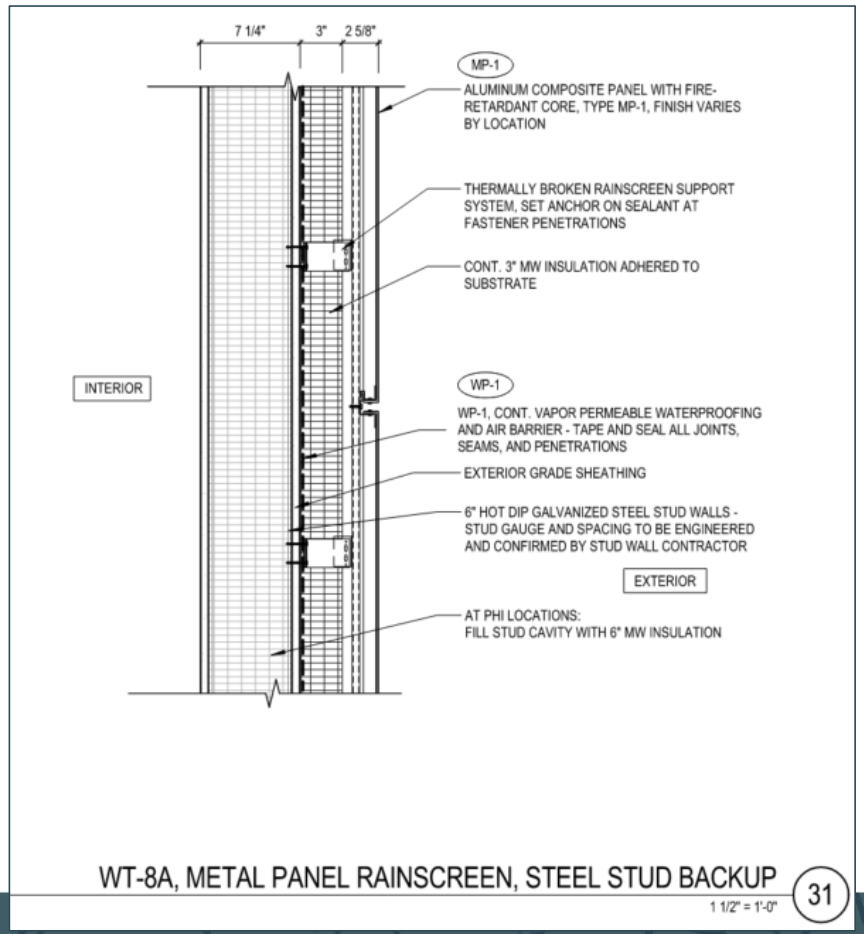
1 1/2" = 1'-0"

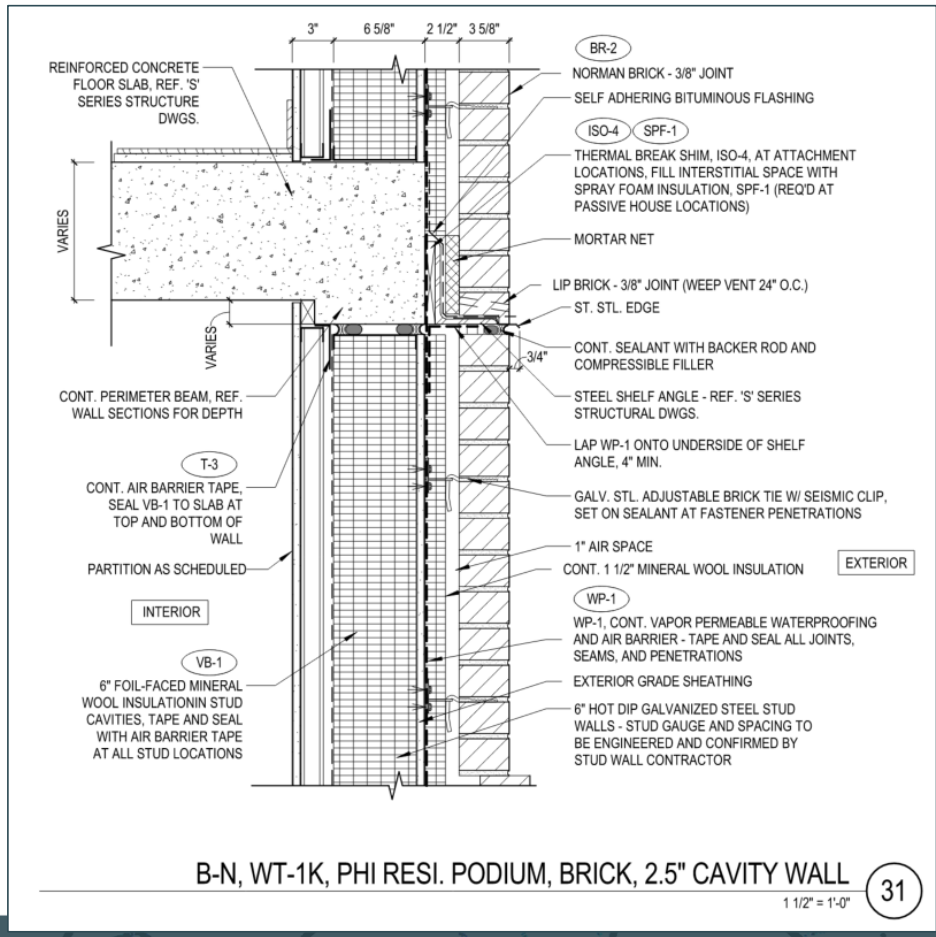


B-N, WT-2A, 6" EIFS ASSEMBLY, STL. STUD BACKUP 32

1 1/2" = 1'-0"

Typical Construction Types – **Steel Studs**





Typical Construction Types – **Steel Studs**

Discussion: Tell me what you see going on in this photo.

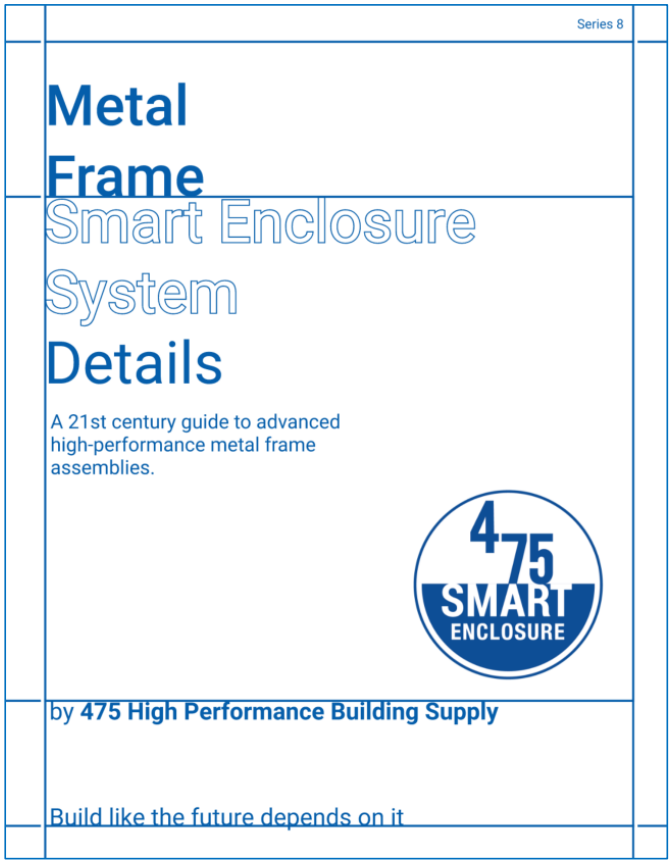


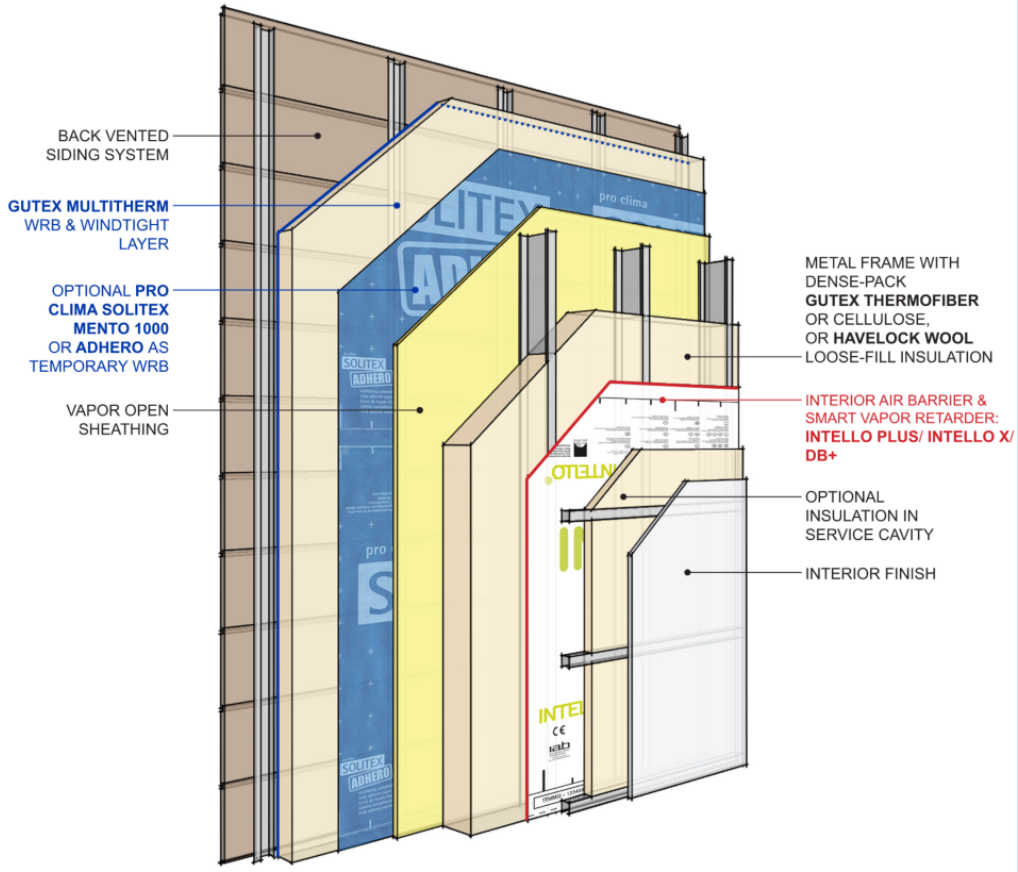
Typical Construction Types – **Steel Studs**

- Steel studs
- Exterior grade gypsum
- Fluid applied air barrier
- Sheet applied air barrier
- Exterior insulation
- Assumed finish of brick and EIFS
- PTACs



Typical Construction Types – **Steel Studs**





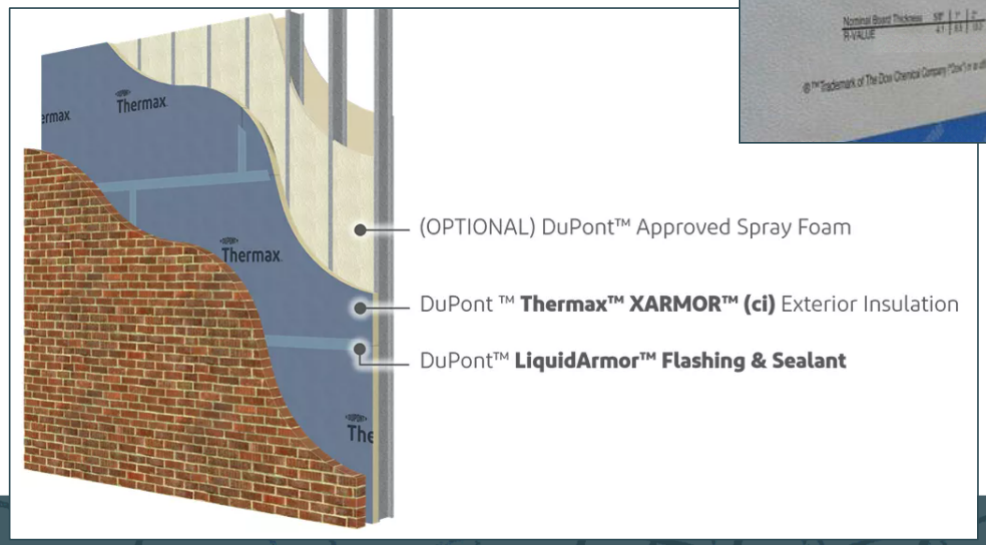
https://foursevenfive.com/content/product/smart_enclosure/metal_frame/475_Metal_Frame_eBook_Nov_2019_Spread.pdf

Typical Construction Types – **Steel Studs**

Thermax polyiso sheathing: Acts as insulation and air barrier.

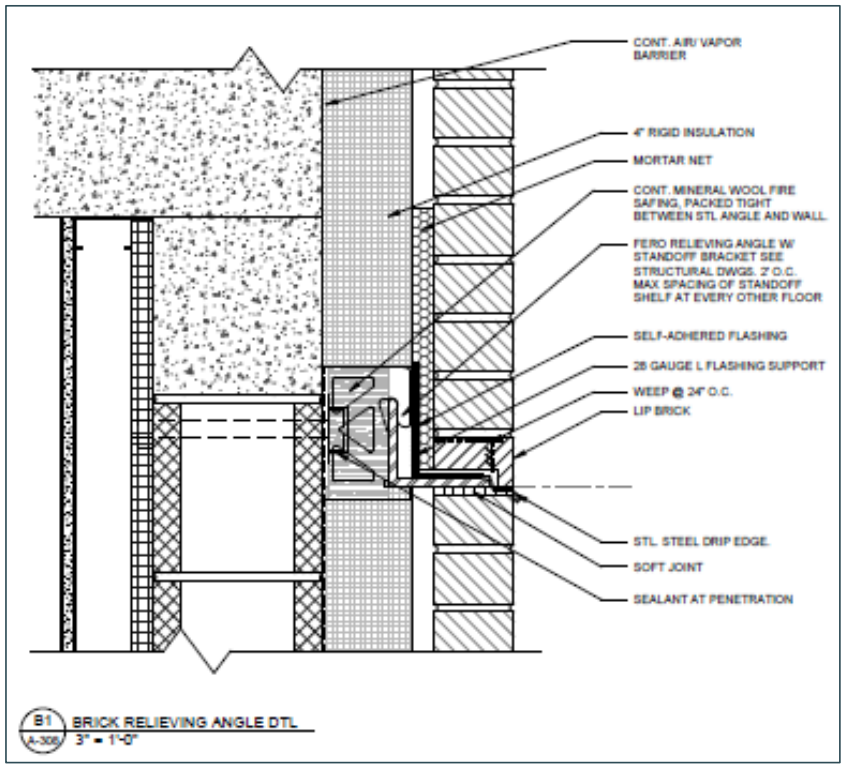
But be careful.

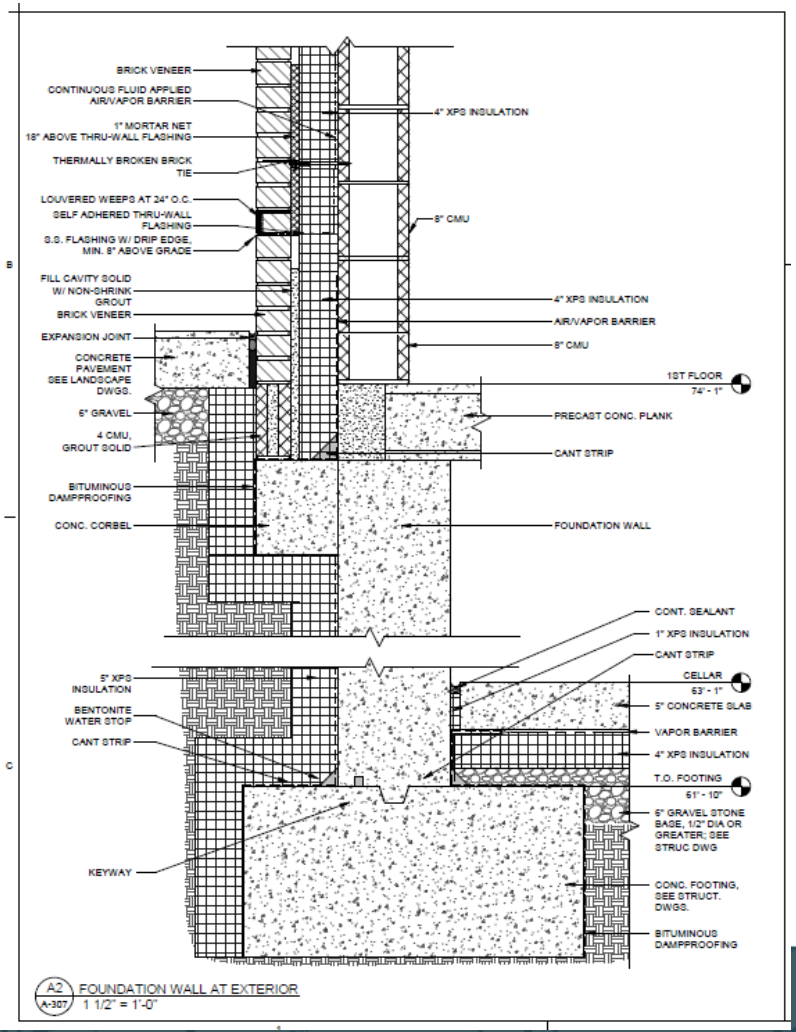






Typical Construction Types – **CMU**





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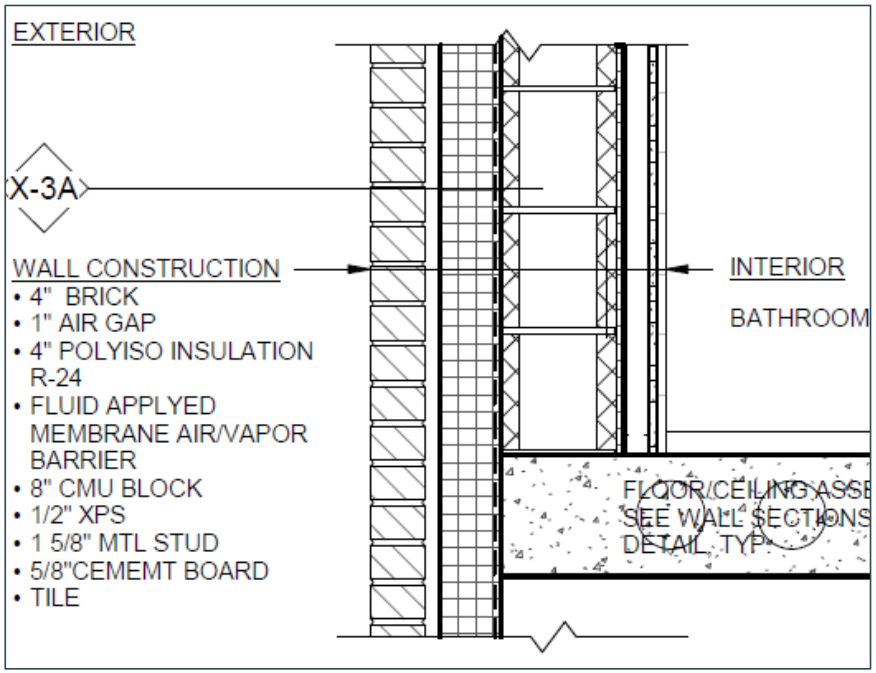
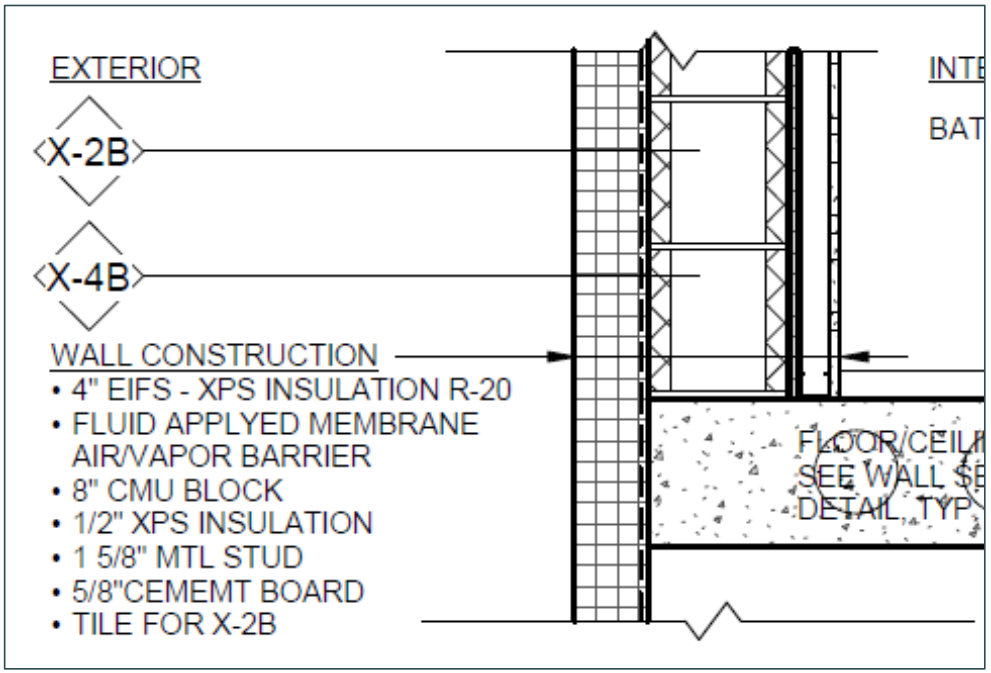


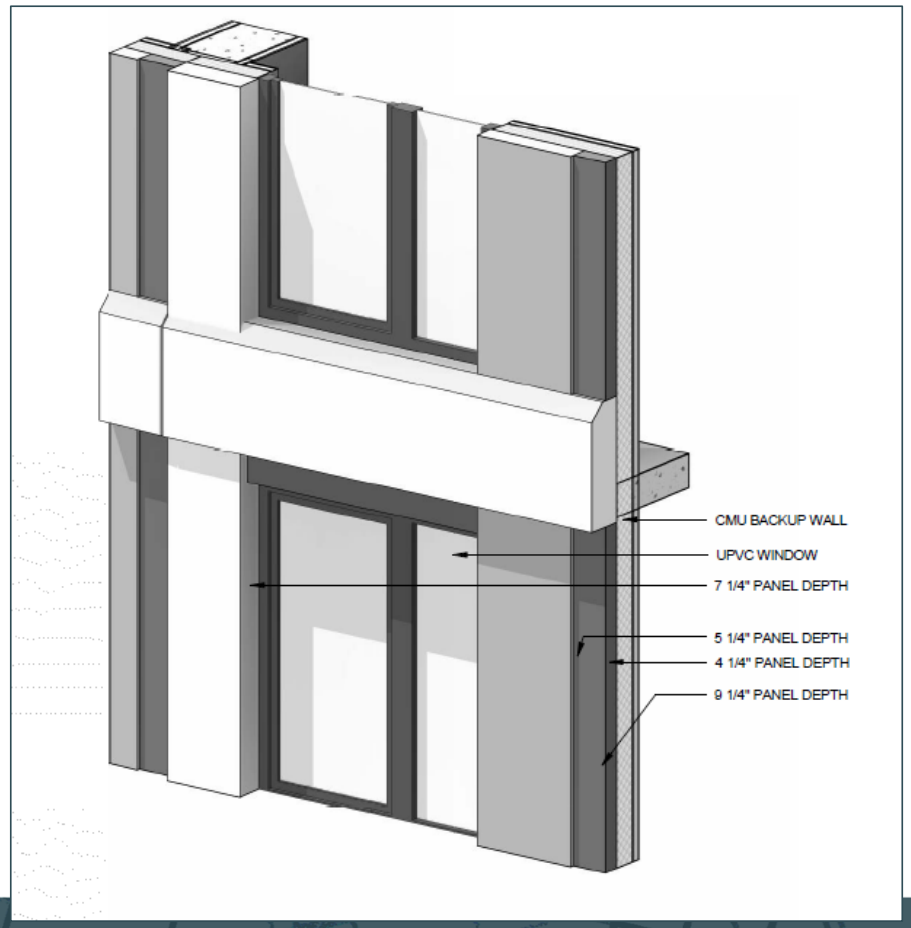


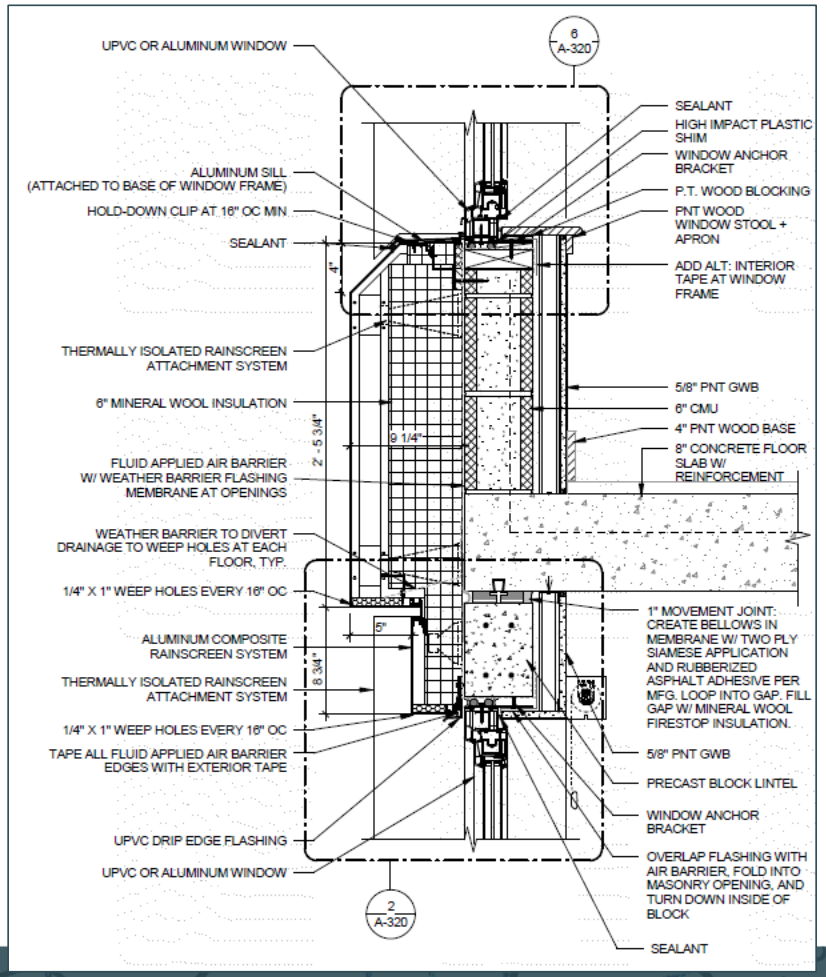
Typical Construction Types – **CMU**



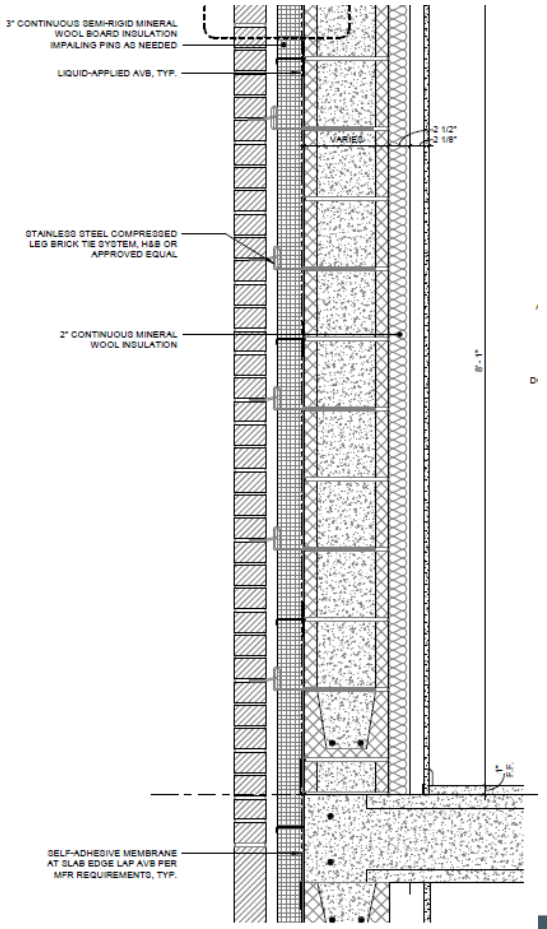


Typical Construction Types – **CMU**

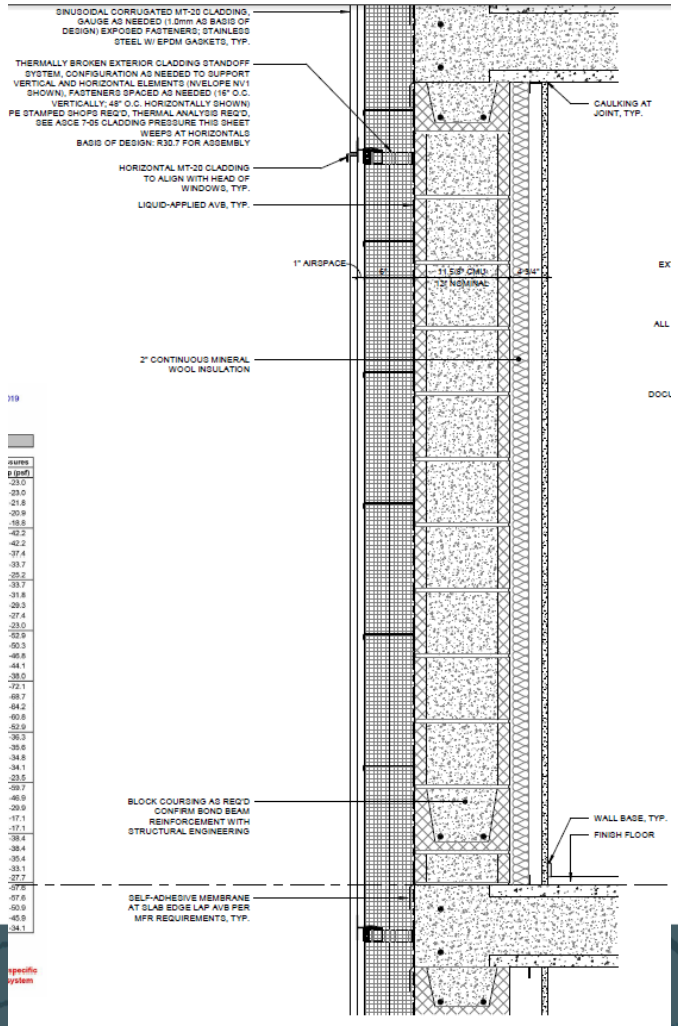




Typical Construction Types – **CMU**

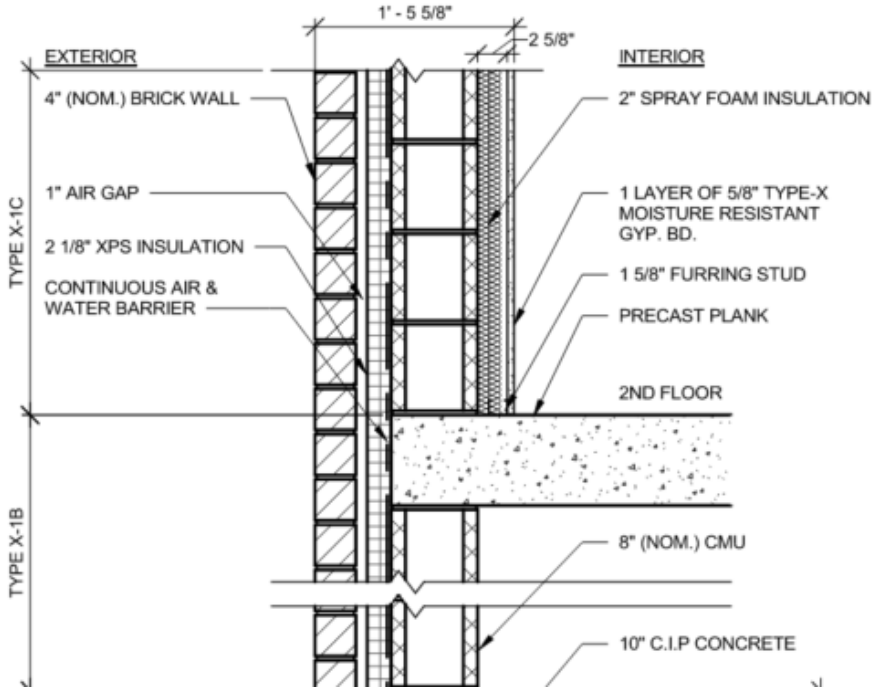


7 DETAIL SECTION - TYP BRICK WALL
1 1/2" = 1'-0"



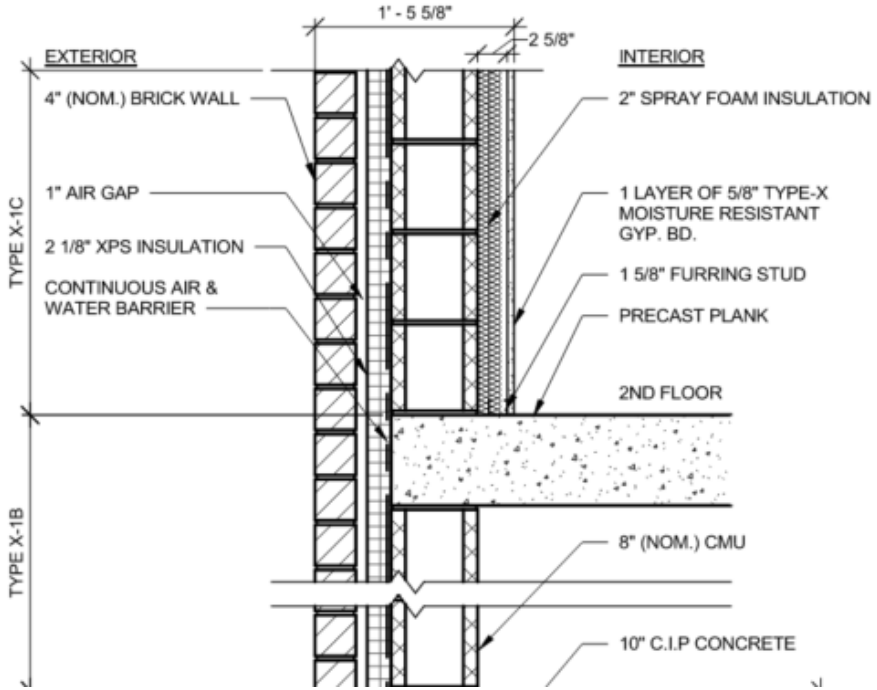
Typical Construction Types – **CMU**





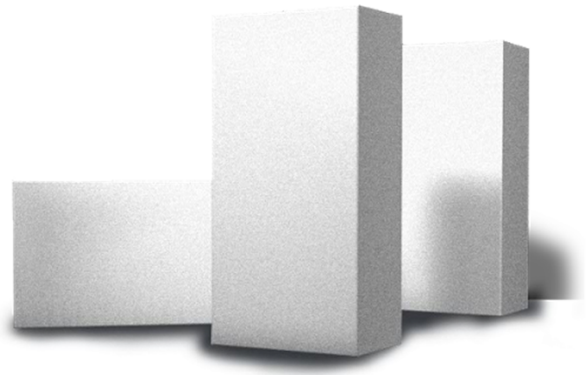
Typical Construction Types – **CMU**





Not So Typical Construction Type – **AAC Block**

- Autoclaved aerated concrete (AAC): a lightweight, precast, foam concrete building material suitable for producing concrete masonry unit (CMU) like blocks.
  - Composition: quartz sand, calcined gypsum, lime, cement, water and aluminum powder, cured under heat and pressure





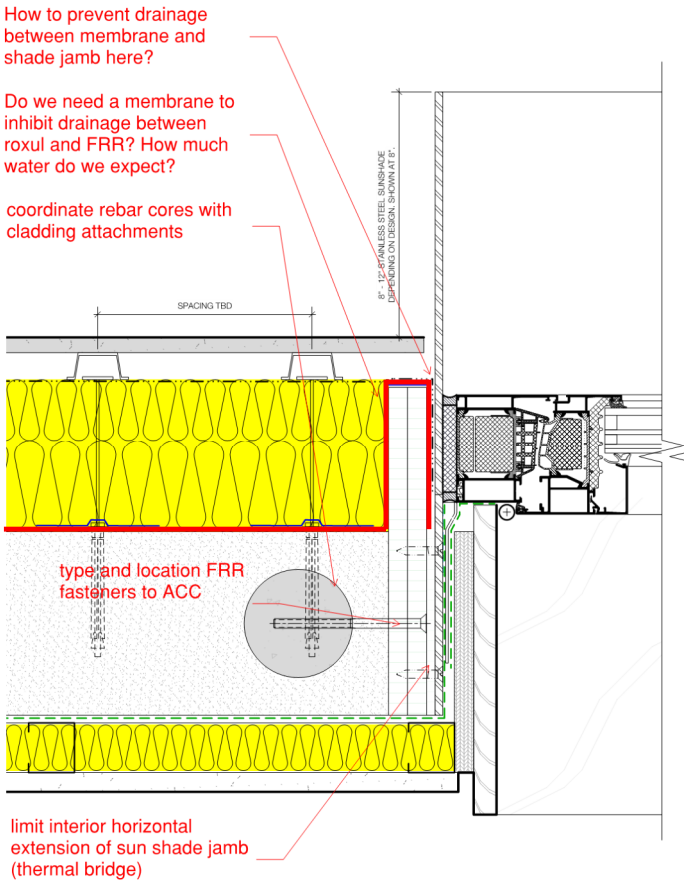
Not So Typical Construction Type – **AAC Block**

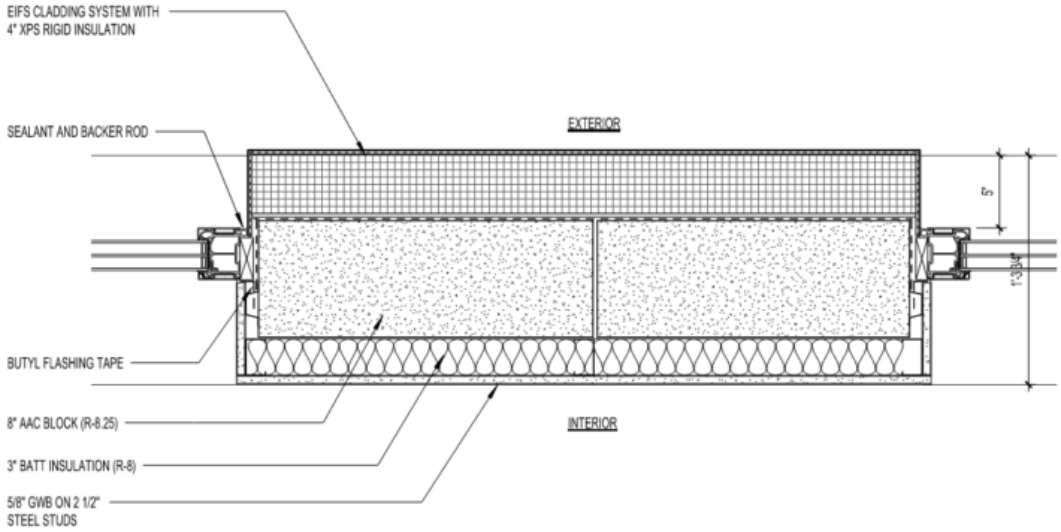
- **AAC Benefits** (to name a few)
  - Workable with hand tools, lightweight, fireproof, thermal insulation, less portland cement, noise reduction, moisture regulation

  AAC + PH = ✓
- **AAC Blocks** – Made by YTONG, Aercon Florida, etc



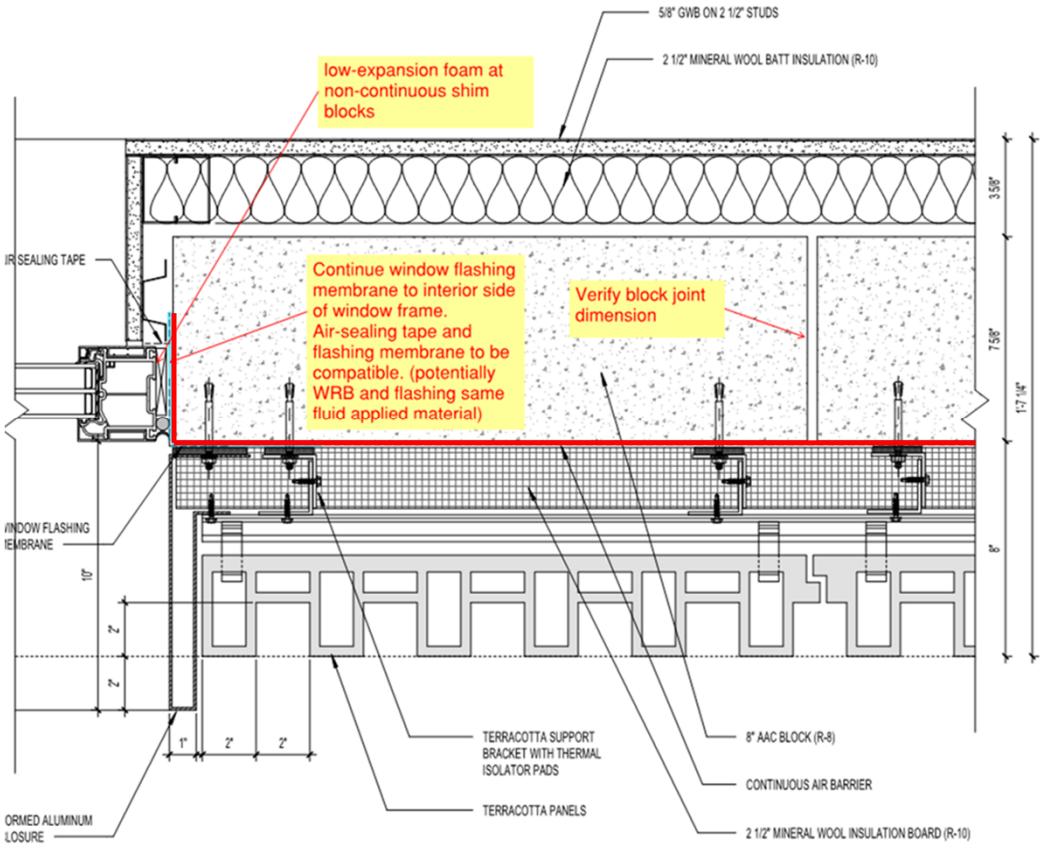
Not So Typical Construction Types – **AAC Block**

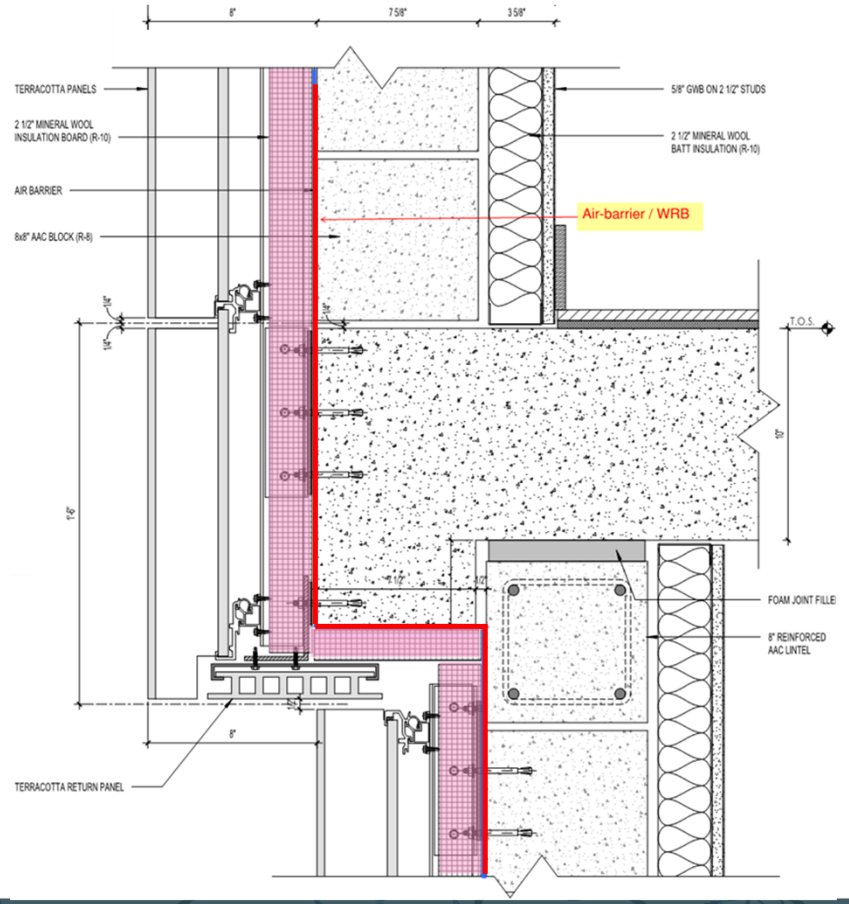




PLAN DETAIL AT EIFS WALL - TYPICAL | 15 | A-420.00
1 1/2" = 1'-0"

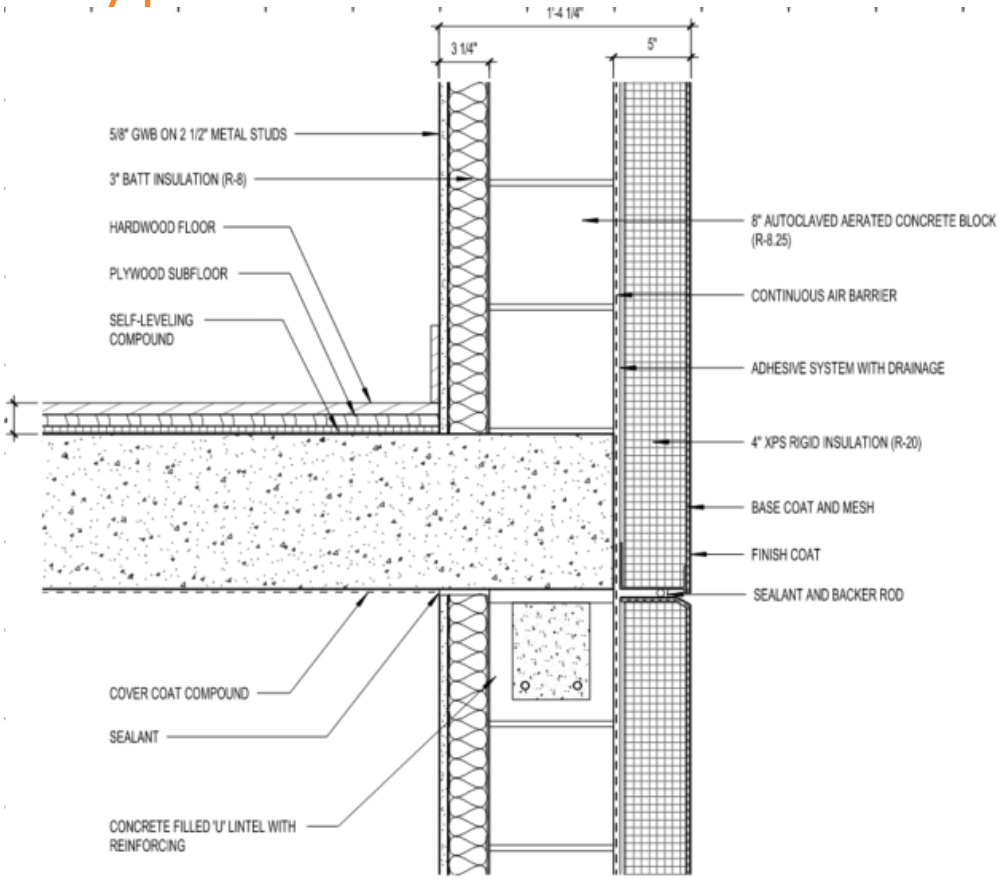
Not So Typical Construction Types – **AAC Block**





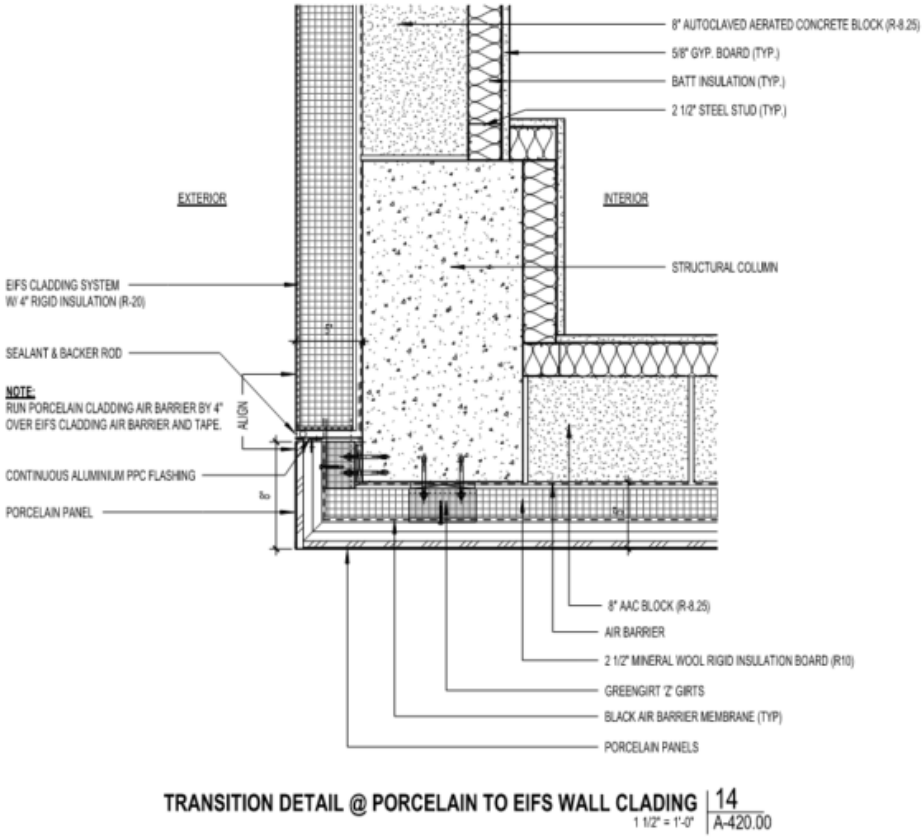
Not So Typical Construction Types – **AAC Block**



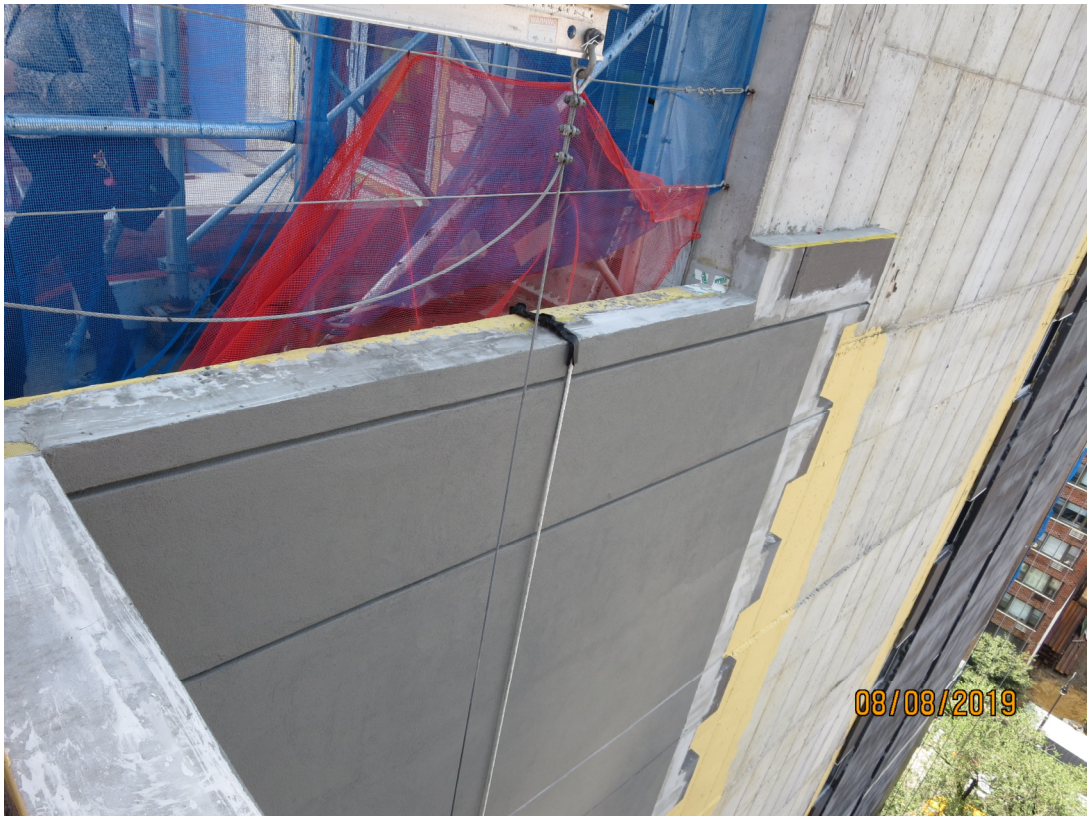


TYPICAL WALL SECTION WITH EIFS | 2 | A-420.00
1 1/2" = 1'-0"

Typical Construction Types – **AAC Block**

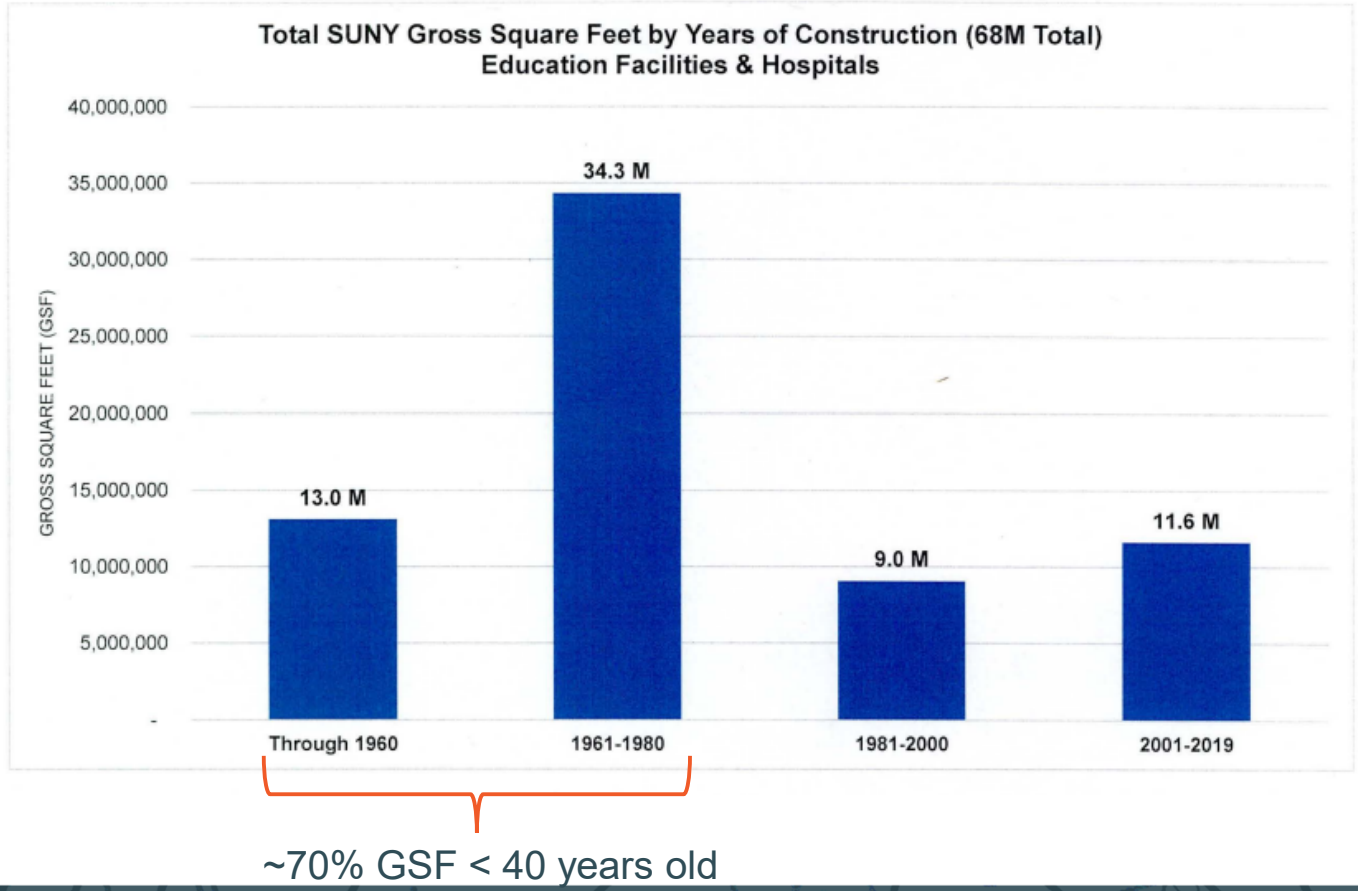


TRANSITION DETAIL @ PORCELAIN TO EIFS WALL CLADING | 14 | A-420.00
1 1/2" = 1'-0"



Existing Buildings – Renovations and Retrofits

Existing buildings present a large opportunity to incorporate net-zero features in pending renovations and retrofits.



Existing Buildings

- Maintaining an airtight and well insulated building envelope is very challenging in existing structures
- Typically, interior application of both insulation and air barrier is required to preserve historic nature of the building



https://passivehouseplus.ie/magazine/insight/energiesprong

Exterior Applications

"Replicability of the retrofit to the building envelope and energy systems. **Provide a ZNC-ready retrofit solution (improving envelope and energy systems in tandem) that can be replicable with other SUNY residence halls undergoing substantial or moderate rehabilitation, or no rehabilitation at all**, preferably over a summer construction timeframe of less than three months. It is therefore expected that a substantial part of the retrofit elements (envelope and mechanical systems) will be **pre-fabricated or assembled off-site.**" – RFQ Language for Ford Residence Hall

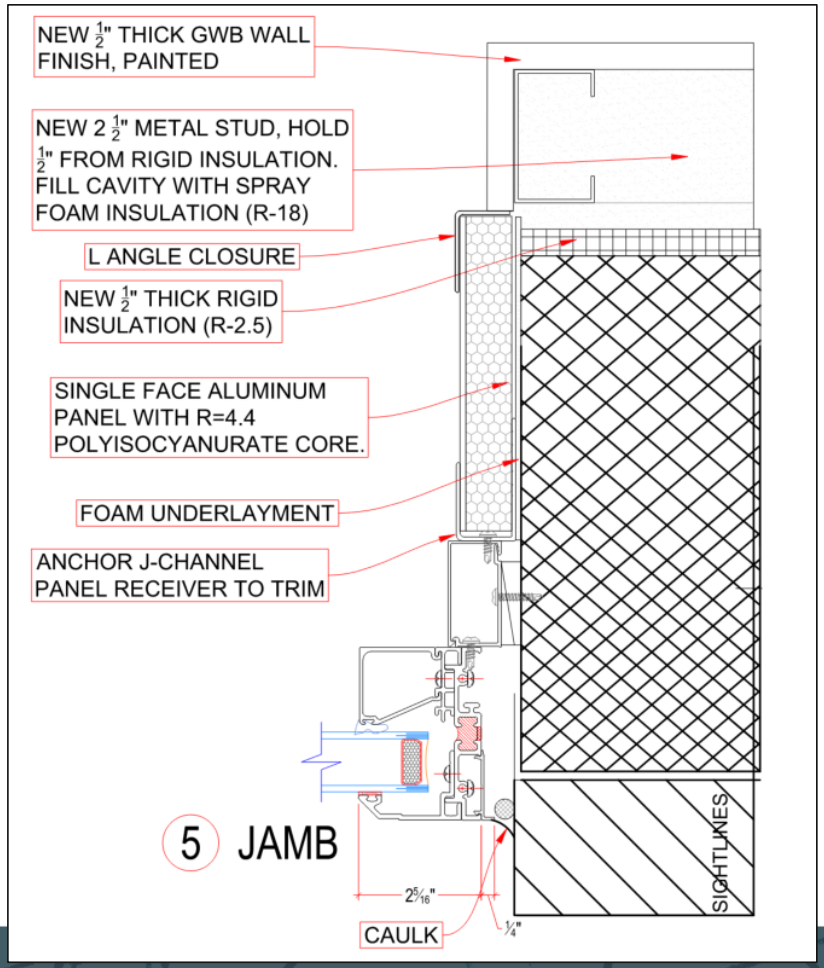


Ford Hall on the SUNY Oneonta campus

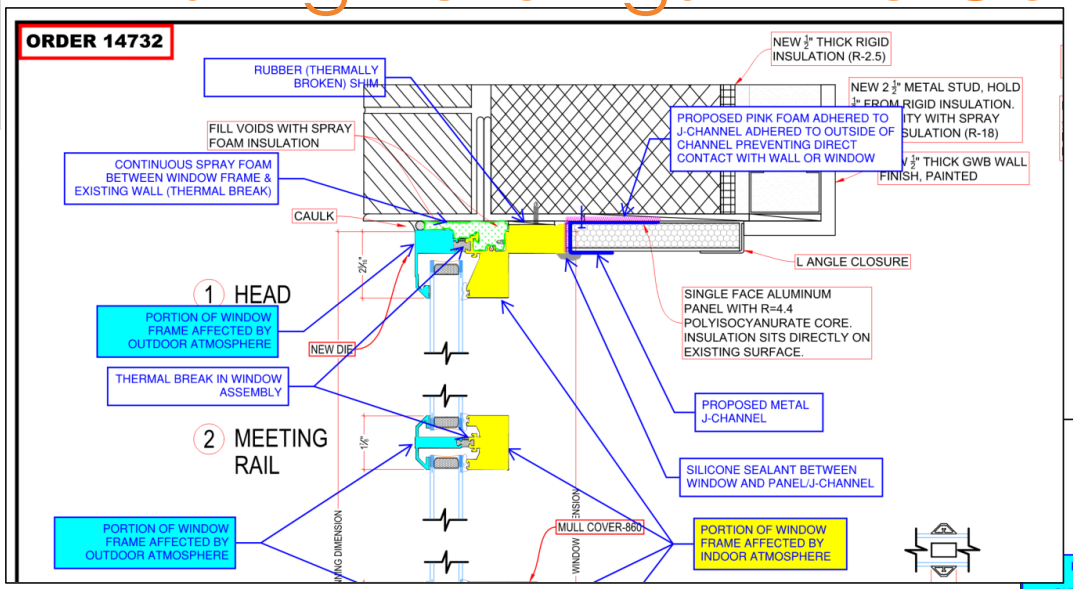
Existing Buildings: The Good, The Bad and, The Ugly

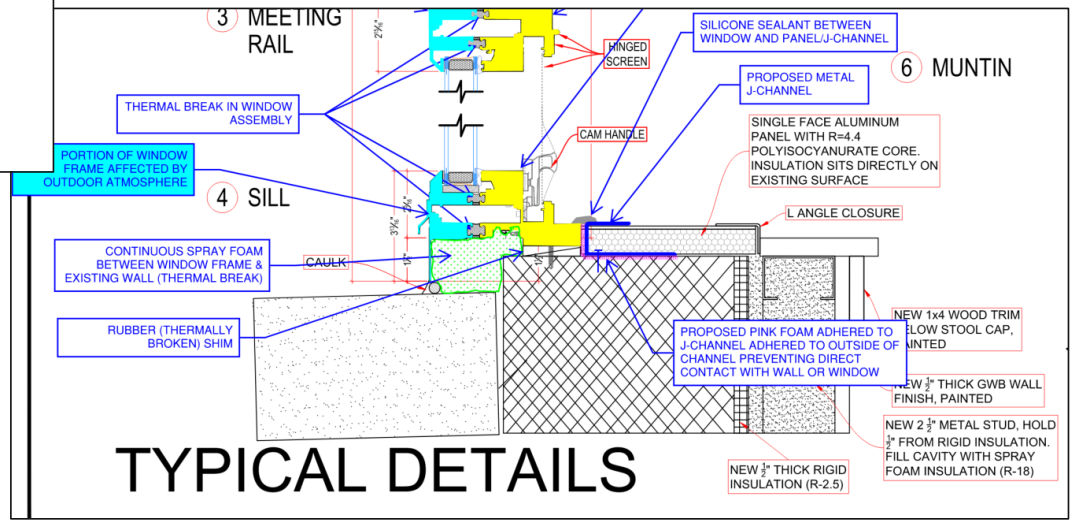
Existing Buildings – **The Good**

- Interior spray foam is a viable solution for insulating and air sealing from the interior
- Different iterations of shop drawings through out the design and implementation of this strategy



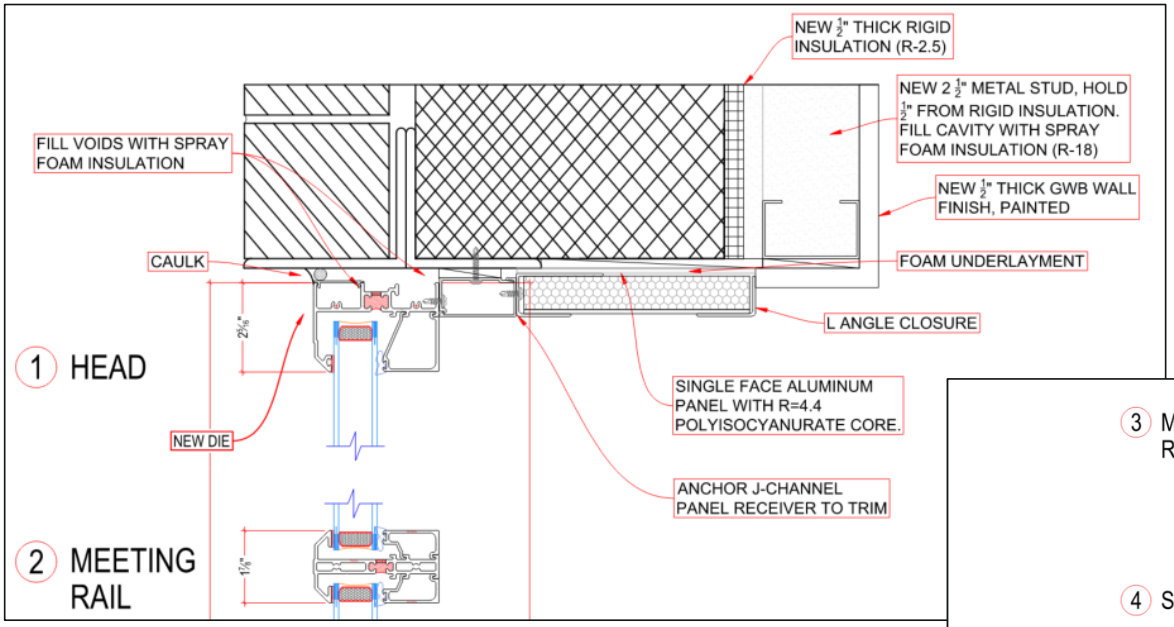
Existing Buildings – **The Good**

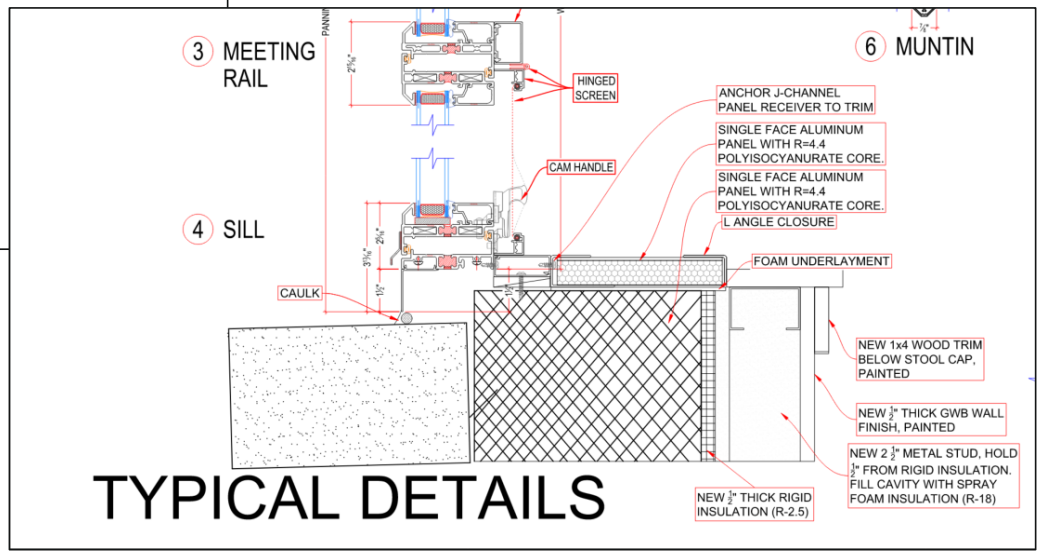




Marked-up Shop Drawings

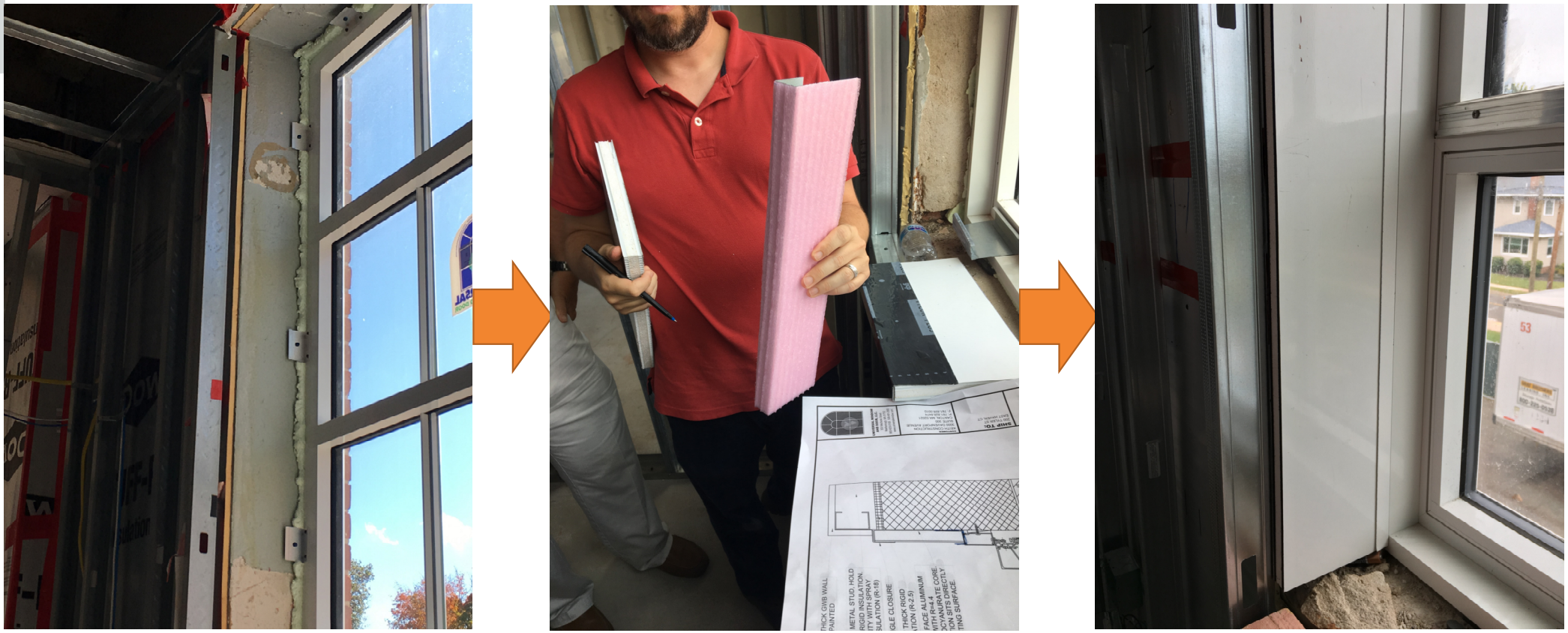
Existing Buildings – **The Good**





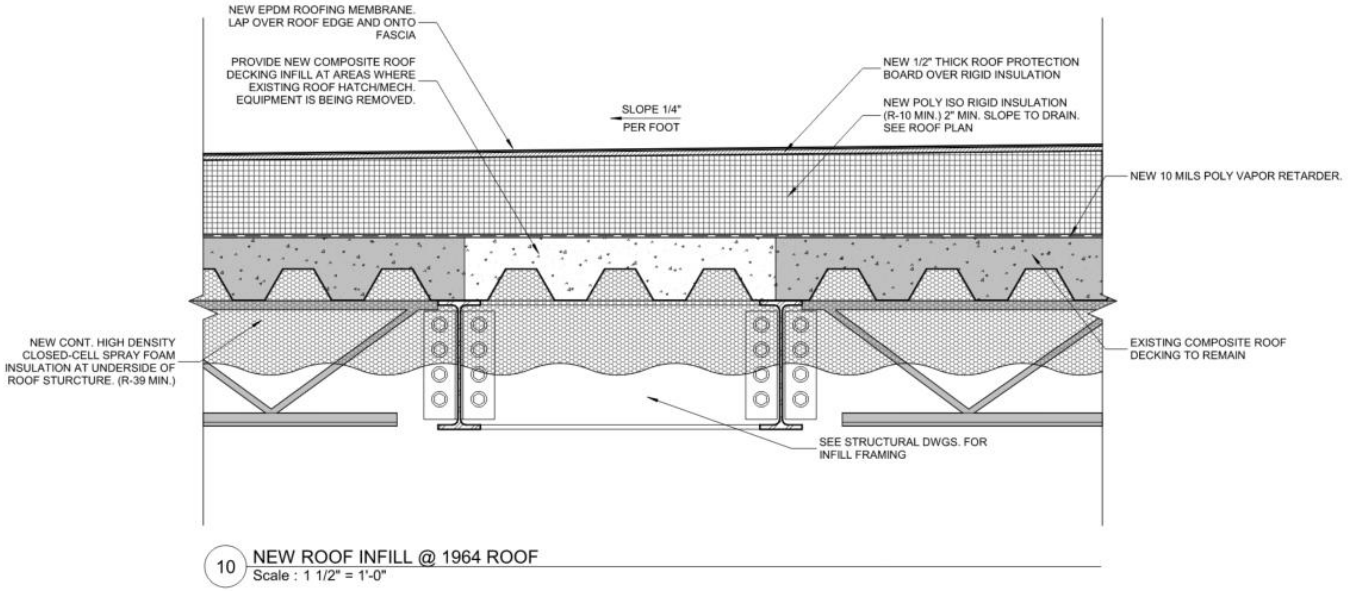
Updated Shop Drawings

Existing Buildings – **The Good**



In-field Conditions

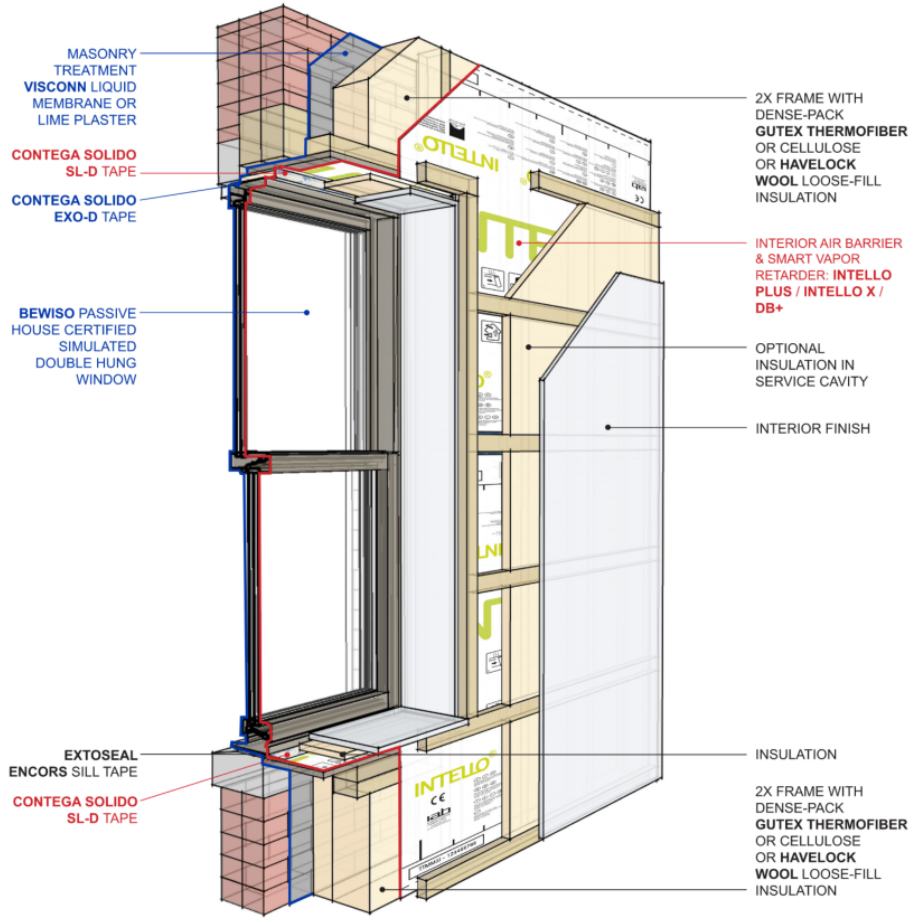
Existing Buildings – **The Good**





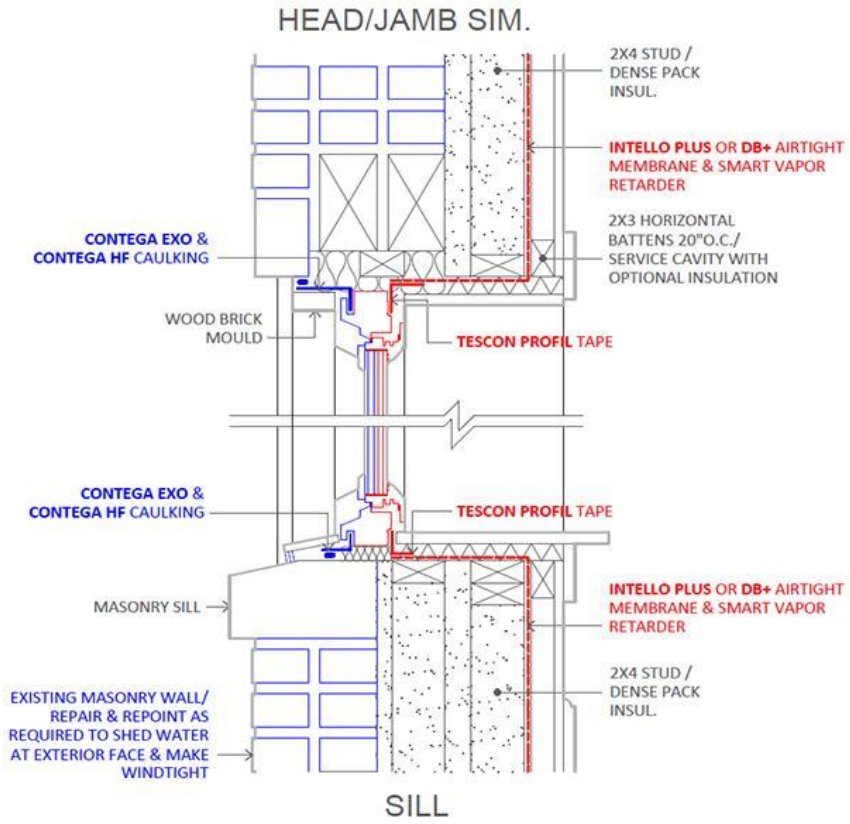
In-field Conditions

Existing Buildings – **The Good**



https://foursevenfive.com/masonry-retrofit/

Existing Buildings – **The Good**





In-field Conditions https://foursevenfive.com/masonry-retrofit/

Existing Buildings – **The Bad**

- Interior application of both insulation and air barrier is required for this historic preservation brownstone project
  - Air barrier and insulation solution: Interior insulation boards “taped at the seams”
  - What do you see wrong with these photos?







Existing Buildings – **The Ugly**







Existing Buildings – **The Ugly**







Questions?



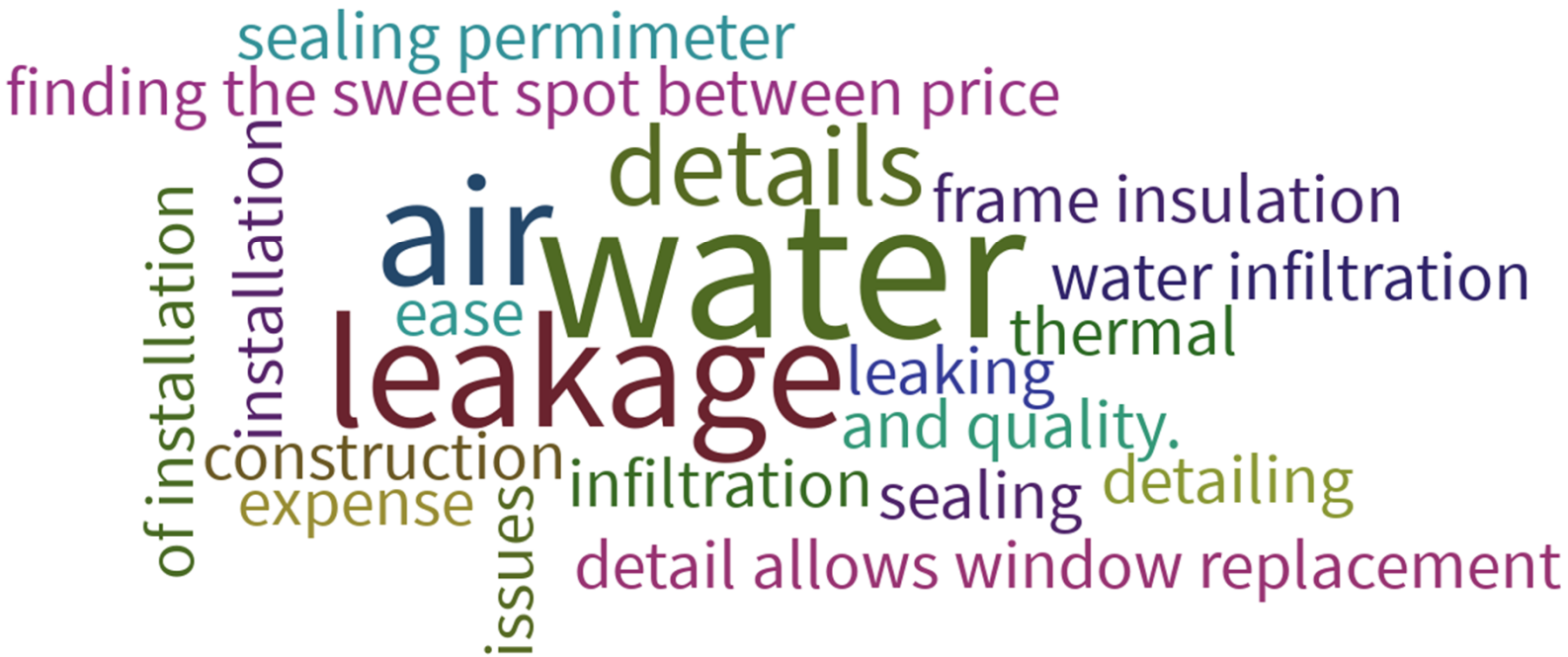
10 Minute Break

High Performance Windows

When poll is active, respond at **PollEv.com/swa335**

Text **SWA335** to **22333** once to join

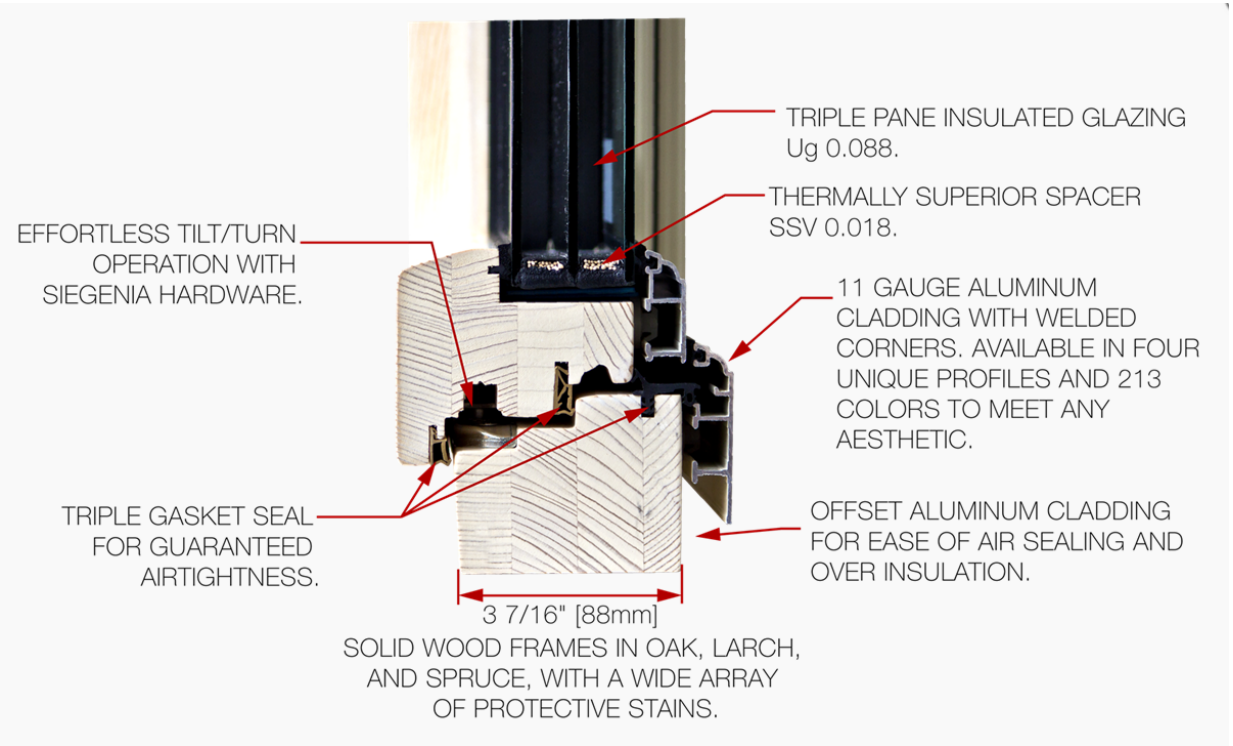
What is your biggest concern regarding windows?



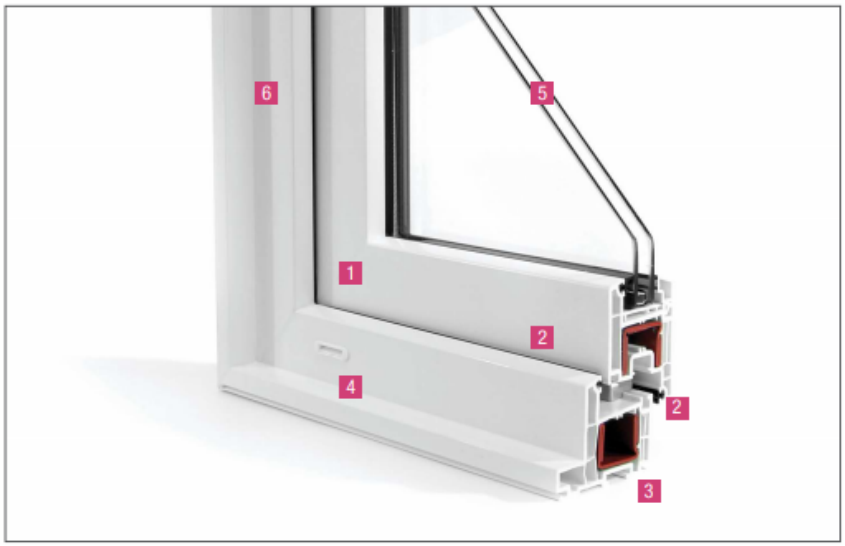
PH Windows & Doors

- U-value of glass as low as U-0.088 (R-11)
- U-value of frame 0.15 (R-6.7)
- Installation considerations (typical):
  - Thermal bridge free installation: frames covered with insulation (typically)
  - Airtightness of the window
  - Airtight installation
- Passive House doors, where applicable

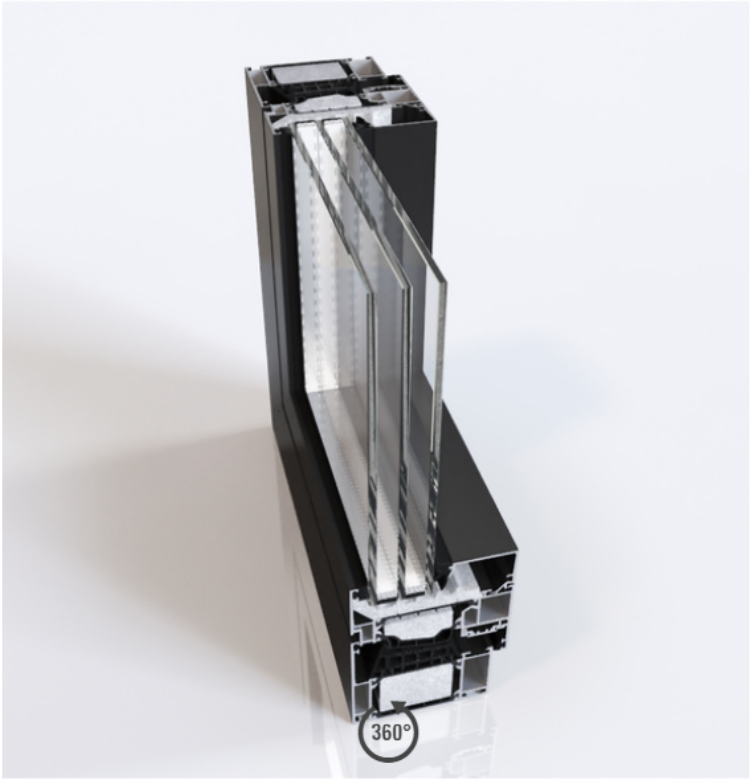
PH Windows


TRIPLE PANE INSULATED GLAZING
Ug 0.088.
THERMALLY SUPERIOR SPACER
SSV 0.018.
EFFORTLESS TILT/TURN
OPERATION WITH
SIEGENIA HARDWARE.
11 GAUGE ALUMINUM
CLADDING WITH WELDED
CORNERS. AVAILABLE IN FOUR
UNIQUE PROFILES AND 213
COLORS TO MEET ANY
AESTHETIC.
TRIPLE GASKET SEAL
FOR GUARANTEED
AIRTIGHTNESS.
OFFSET ALUMINUM CLADDING
FOR EASE OF AIR SEALING AND
OVER INSULATION.
3 7/16" [88mm]
SOLID WOOD FRAMES IN OAK, LARCH,
AND SPRUCE, WITH A WIDE ARRAY
OF PROTECTIVE STAINS.

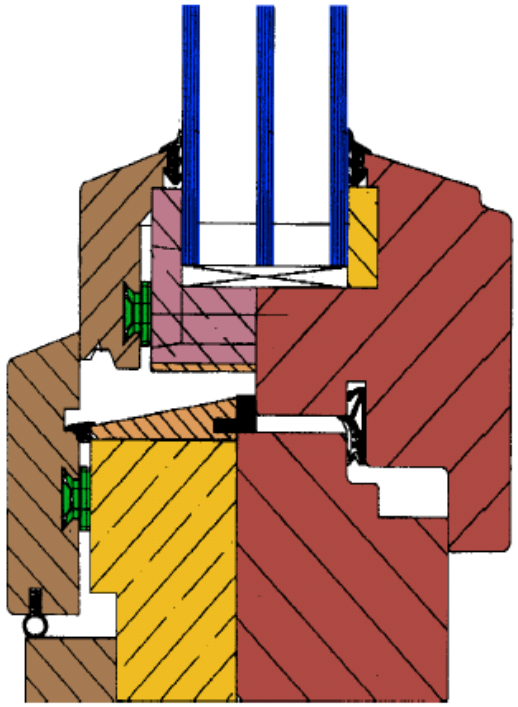
PH Windows

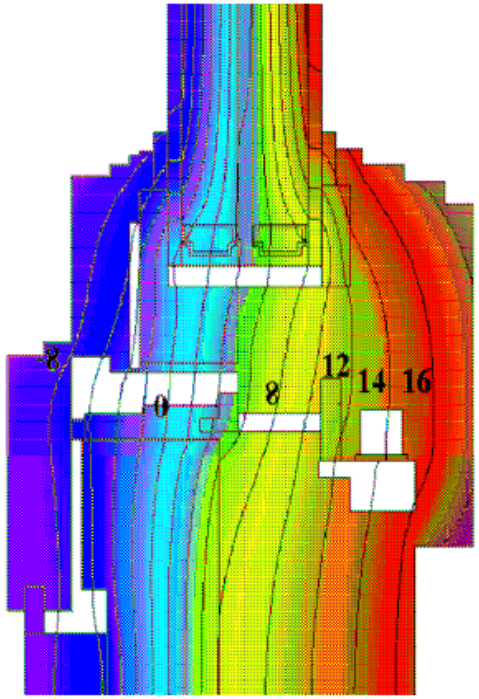


1. **Unique tilt-turn hardware** operates in both top-venting and inward-swinging positions
2. **Multiple locking points and dual weather seals** provide optimal air and water tightness
3. **Large chambers** accommodate reinforcements required for large openings in heavy commercial applications
4. **Accessory groove** accepts a variety of accessories such as brickmolds, extension jambs and for profiles to couple window elements
5. **Up to 1 3/8 in (35 mm) glass** increases energy efficiency and acoustical properties
6. **3 1/4 in (83 mm) North American frame depth** allows for hassle-free replacement installation; we also offer the 2 3/8 in (60 mm) European frame

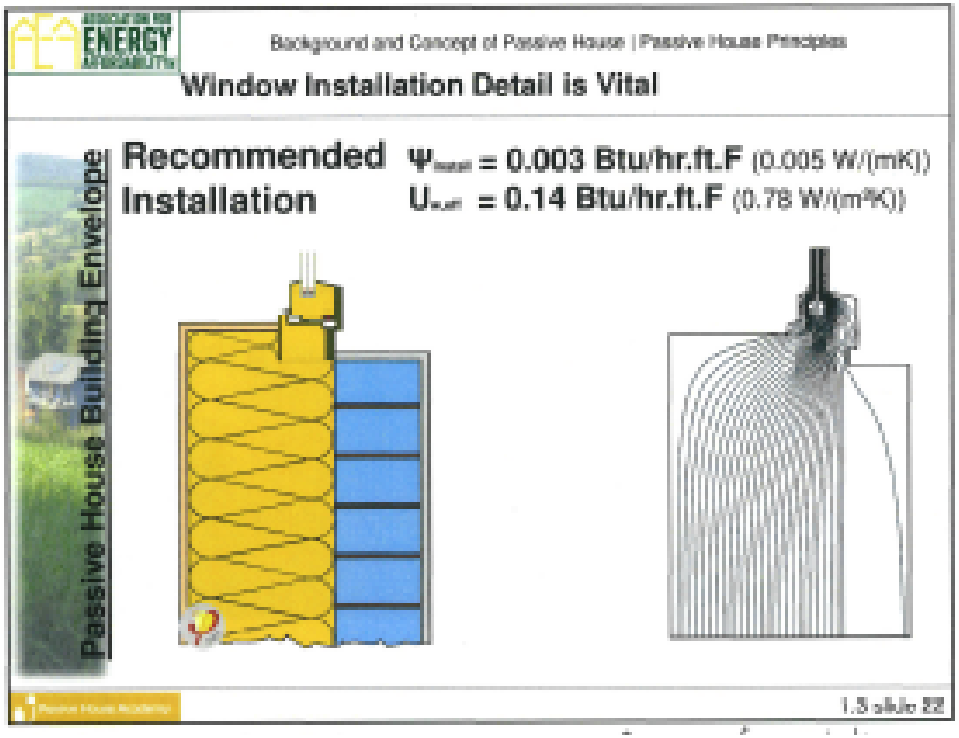


PH Windows

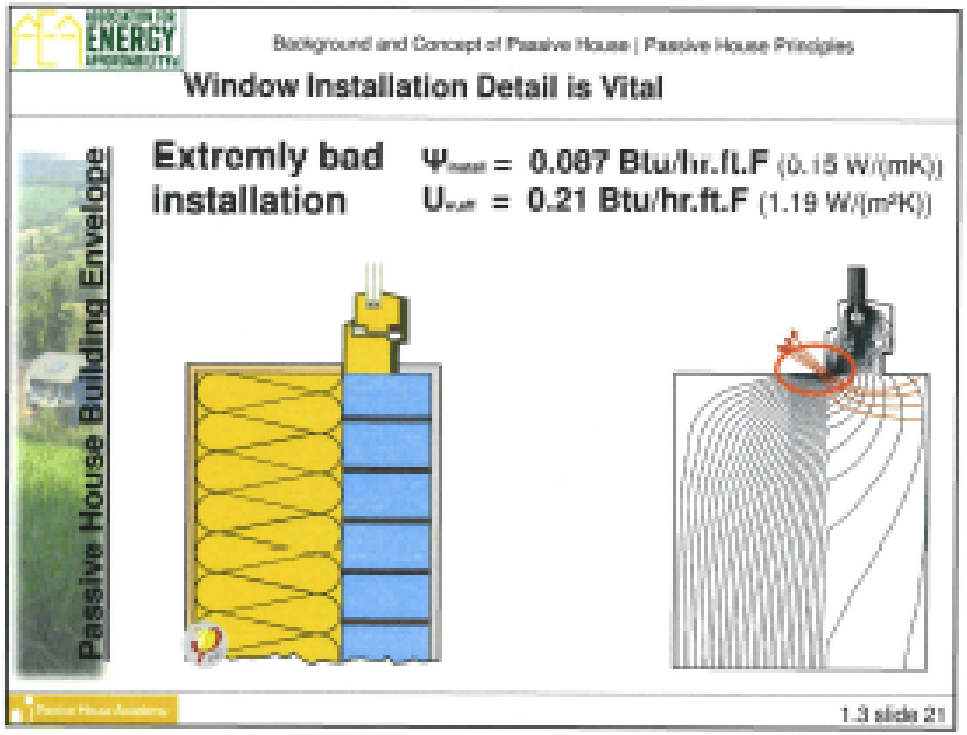




Install Conditions

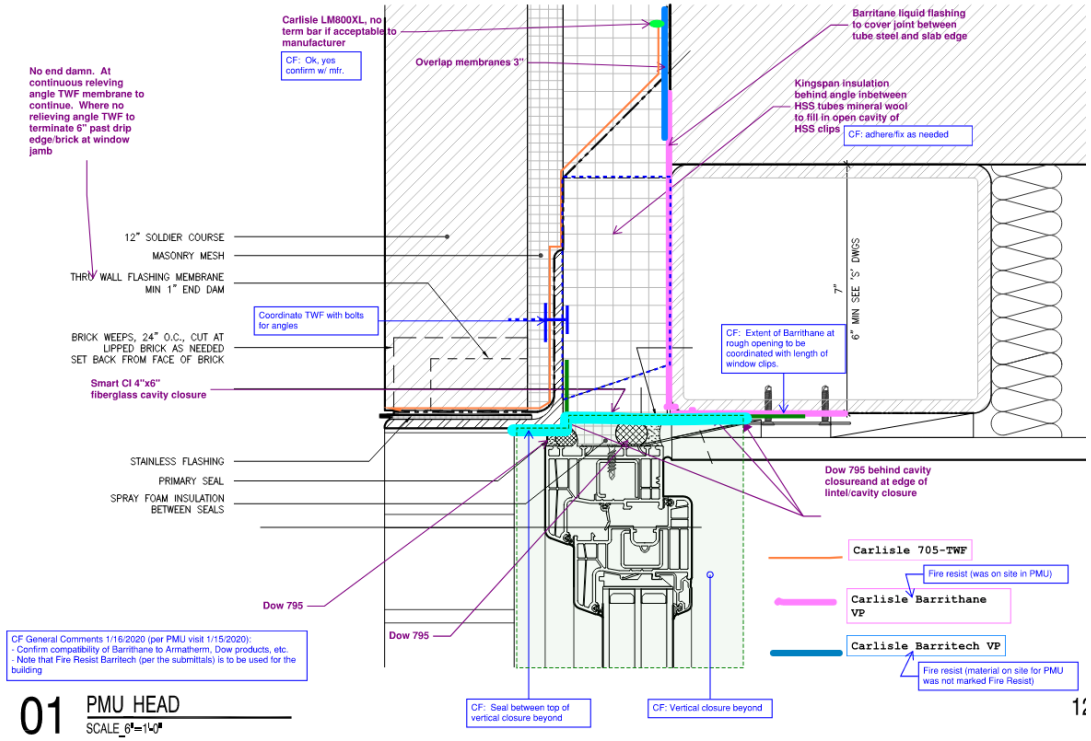


Good Install

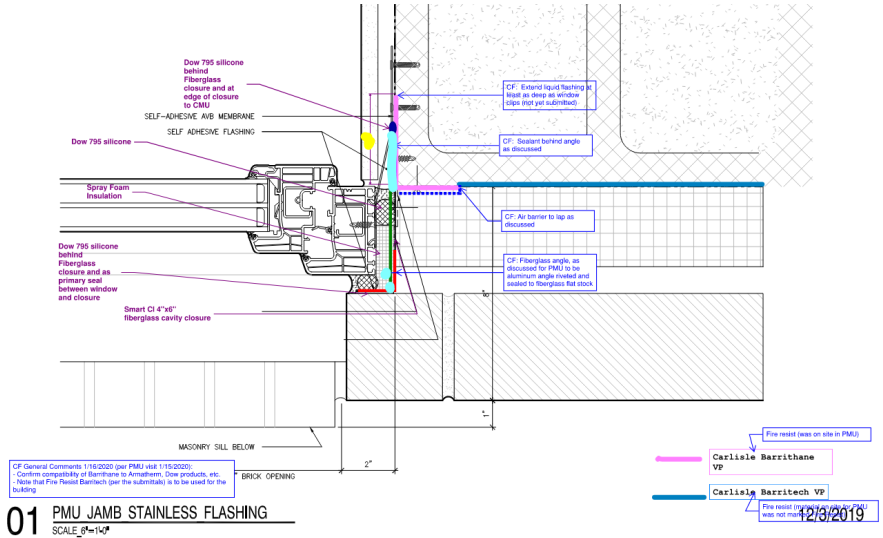


Bad Install

Window Shop Drawings

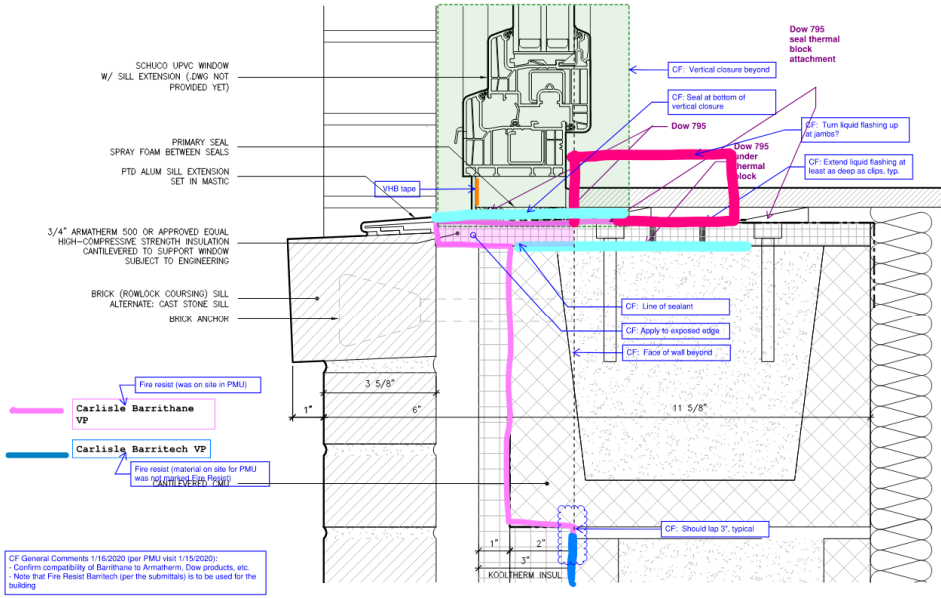


01 PMU HEAD
SCALE 6"=1'-0"



01 PMU JAMB STAINLESS FLASHING
SCALE 6"=1'-0"

12/3/2019



01 PMU SILL: THERMAL BLOCKING A

Rough Opening Preparation







Rough Opening Preparation







Window Installation







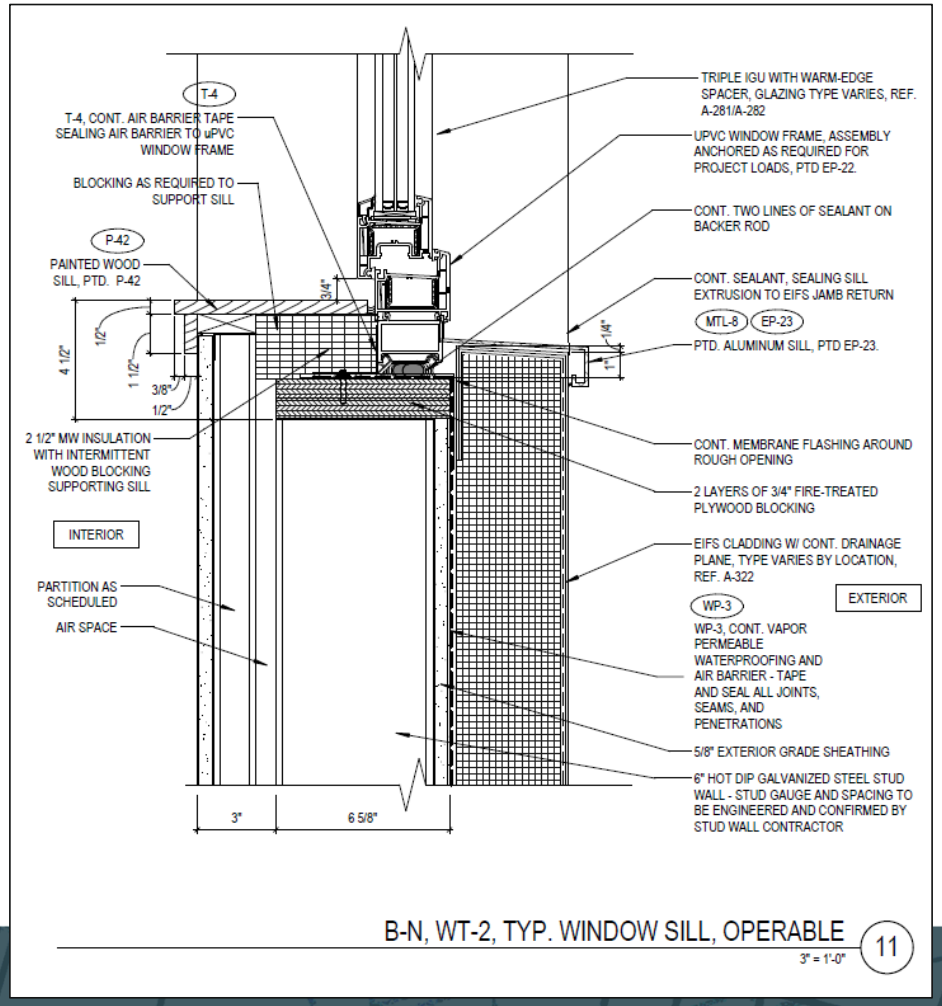
Window Air sealing





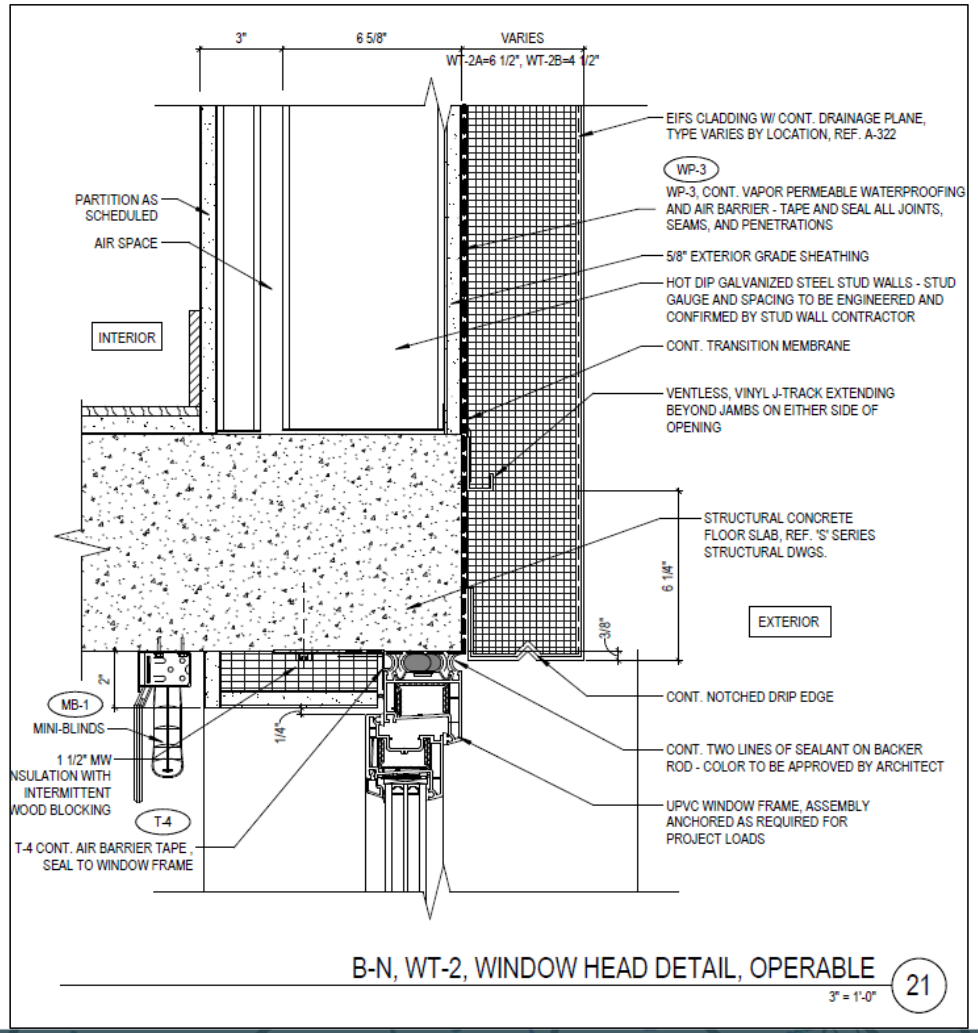


Windows – Steel



B-N, WT-2, TYP. WINDOW SILL, OPERABLE 11

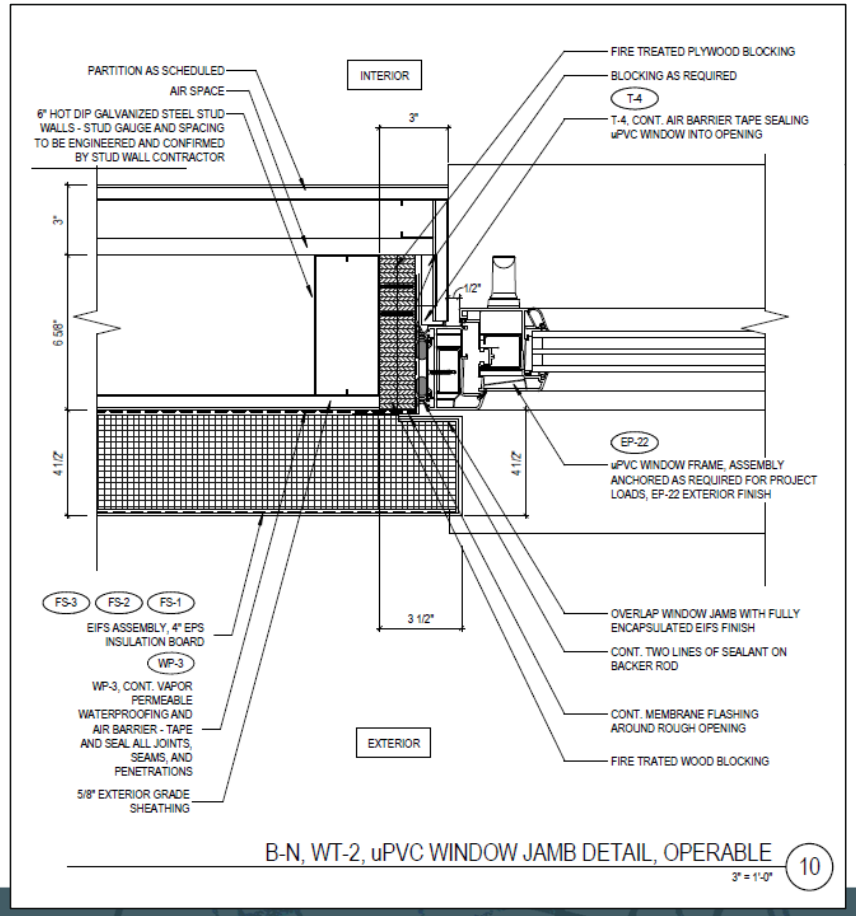
3" = 1'-0"



B-N, WT-2, WINDOW HEAD DETAIL, OPERABLE 21

3" = 1'-0"

Windows – Steel Stud





Windows – Steel Stud





Windows – Mock Ups (AAC & CMU)





Discussion

Can someone tell me a success or failure they had with window installations and what was the outcome?

Windows – AAC (211)





Windows – AAC (211)





Windows – AAC (211)





Windows – AAC (211)





Windows – AAC (211)





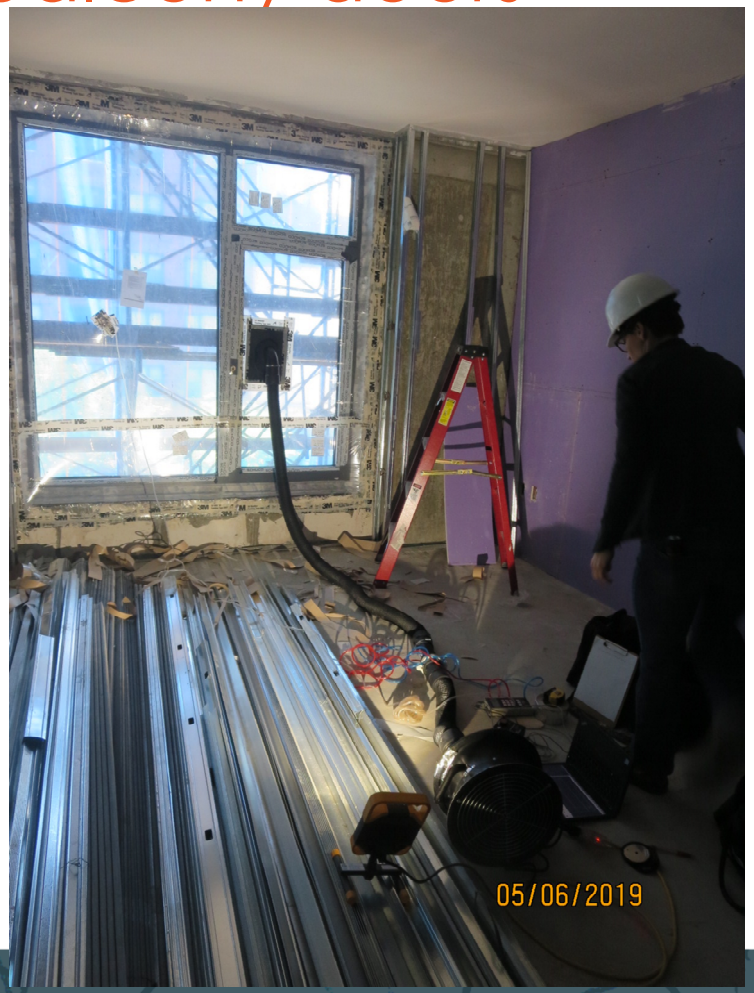
Windows – AAC (511) and balcony doors





Windows – AAC (511) and balcony doors



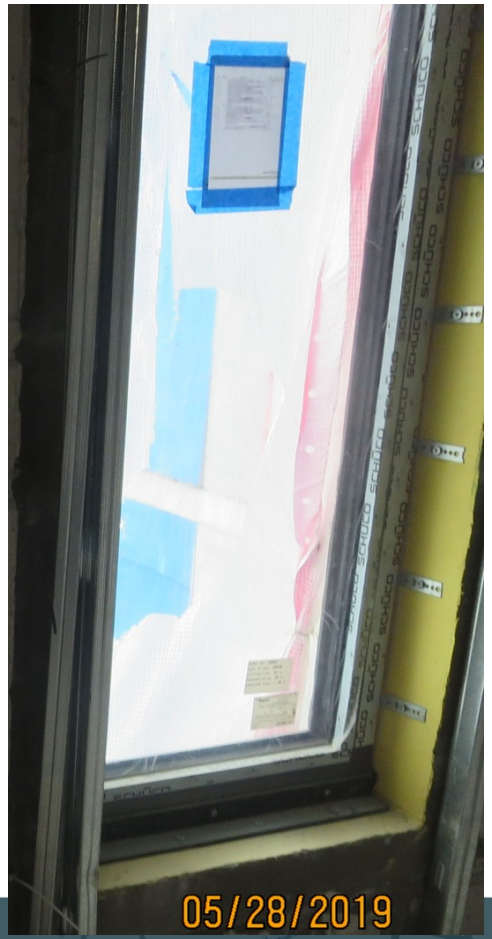


Windows – AAC (511) and balcony doors





Windows – AAC (511) and balcony doors





Windows – AAC (511) and balcony doors





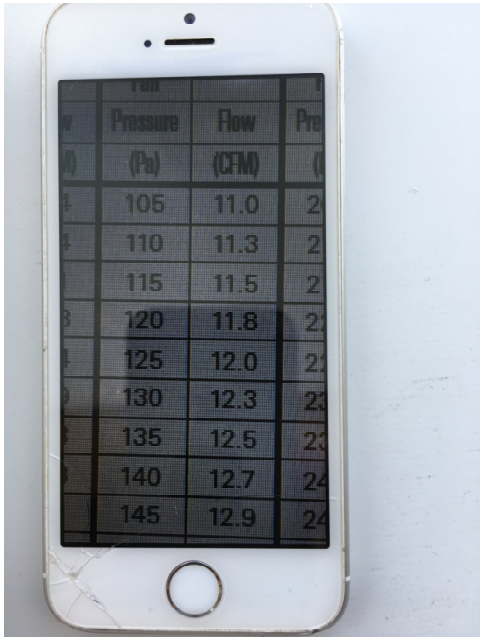
Windows – AAC (511)





Windows – Existing Buildings





Windows – Existing Buildings





Windows – Existing Buildings

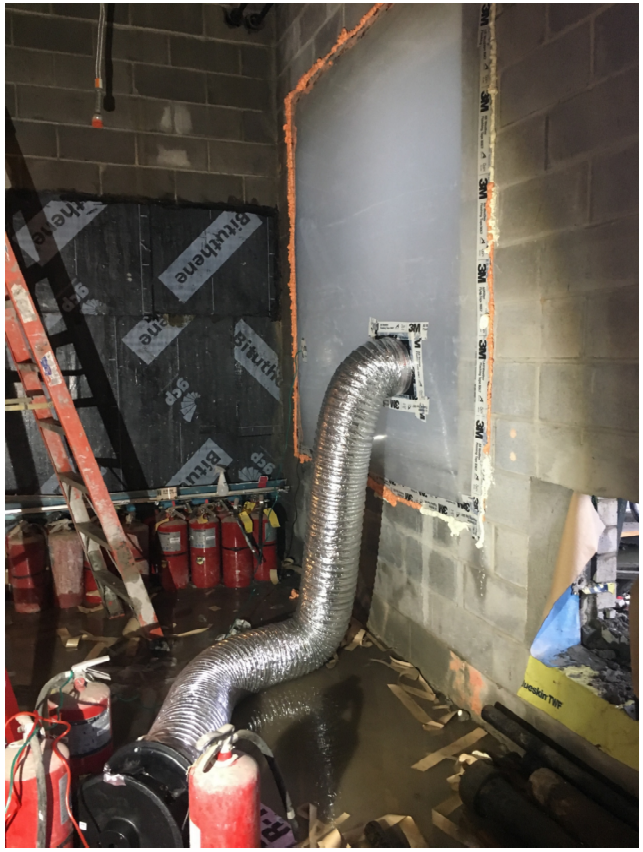




Windows – Testing and More Testing







Questions?



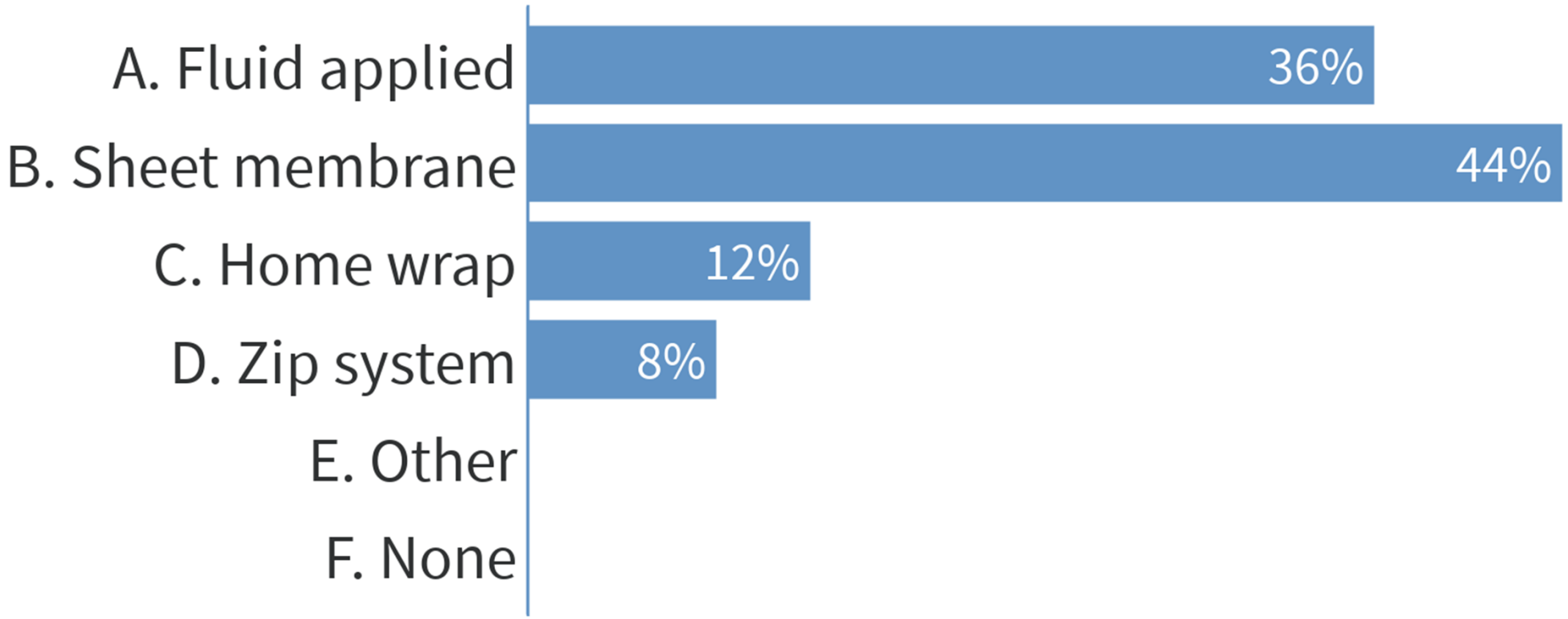
10 Minute Break

Air Barriers and Insulation

When poll is active, respond at **PollEv.com/swa335**

Text **SWA335** to **22333** once to join

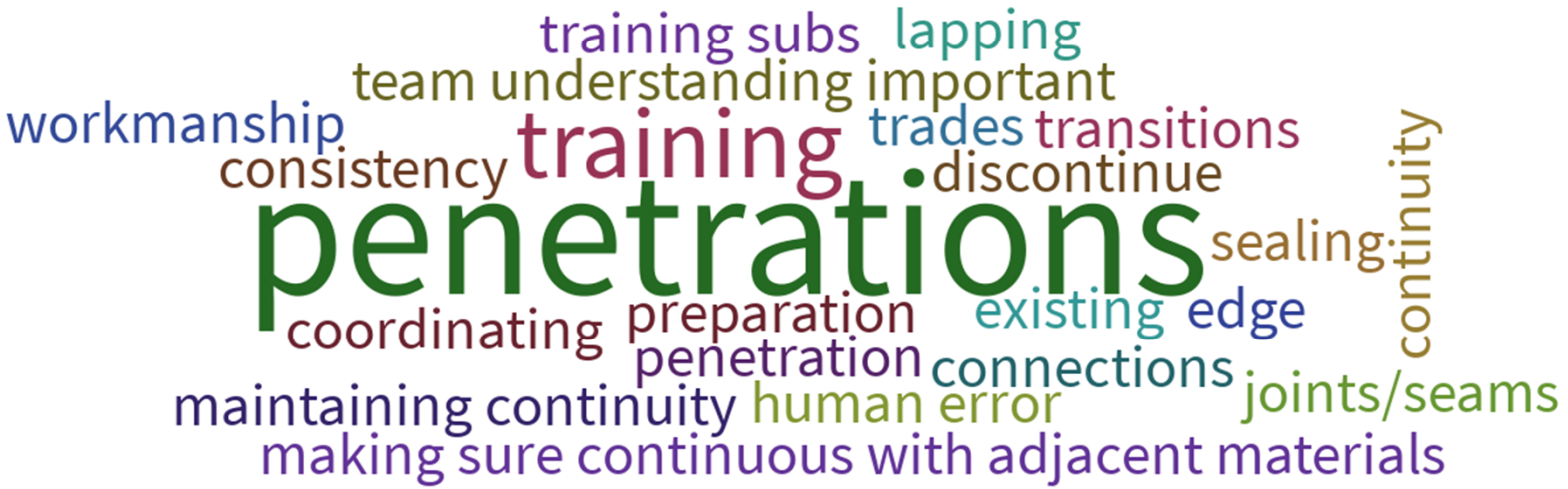
What type of air barrier do you most commonly see?



When poll is active, respond at **PollEv.com/swa335**

Text **SWA335** to **22333** once to join

What do you think is the hardest part of properly installing air barriers?



Directions and Help

- Always consult and follow the manufacturer's data sheet and directions
- Involve product reps as often as needed for assistance

AIR & VAPOR BARRIER

FIRE RESIST **Barrithane VP**

Substrate Inspection

Concrete

Shall be cured in place 3 days minimum. It shall be smooth, with sharp protrusions such as cold joints ground flush. Honeycomb and holes/cracks shall be filled with grout or mortar.

Concrete Masonry Unit (CMU)

Mortar joints shall be struck flush or tooled and shall be free of voids. Mortar droppings shall be removed from brick ties and all other surfaces accepting Barrithane VP and CCW accessories.

Gypsum Sheathing

Sheathing boards shall be flush at joints, with gap between boards according to building code and sheathing manufacturer's requirements. Sheathing boards shall also be securely fastened to the structure with proper fastener type, technique and spacing according to building code and sheathing manufacturer's requirements. Sheathing boards shall be repaired or replaced if inspection reveals moisture damage, mechanical damage or if sheathing boards have exceeded the exposure duration or exposure conditions as required by the sheathing manufacturer.

OSB, Plywood, Lumber, Pressure-Treated Wood

Wood sheathing inspection carries the same protocol given for gypsum sheathing. Also, moisture content, measured with a wood moisture meter in the core of the substrate, shall be below 20%. Do not cover any wooden materials with Barrithane VP or CCW accessories if moisture content is 20% or above. Do not encapsulate wood (such as nailers) with membrane, as this will cause premature rot. In most cases fire-treated and pressure-treated wood must be kiln dried to accommodate the less than 20% moisture content requirement.

Installation

Before application, obtain full, safe access to the area and mask adjacent surfaces to protect from splashes or drips. Verify that the product is within shelf life, as indicated on the product label.

The following conditions shall be detailed in accordance with Barrithane VP standard details:

- Sheathing joints: cover with 2" width tooled ribbon of Barribond or cover with embedded 4" width strip of DCH Reinforcing Fabric
- Rough openings, pipe/duct penetrations, sheathing inside/outside corners shall be treated with one of these methods: 1) 705 FR-A/705 FR-A XLT strip; 2) Trowel application 40 mils wet thickness of Barribond or; 3) Single or multiple coats of Barrithane VP to build minimum 40 mils total wet thickness. If method 2 or 3 is used, fill all cracks and holes with Barribond and coat raw edges of gypsum sheathing with CCW contact adhesive.
- Expansion joints, control joints, termination at head/foot of wall, transitions of dissimilar materials: 705 FR-A/705 FR-A XLT strip bearing 3" onto each side of joint.

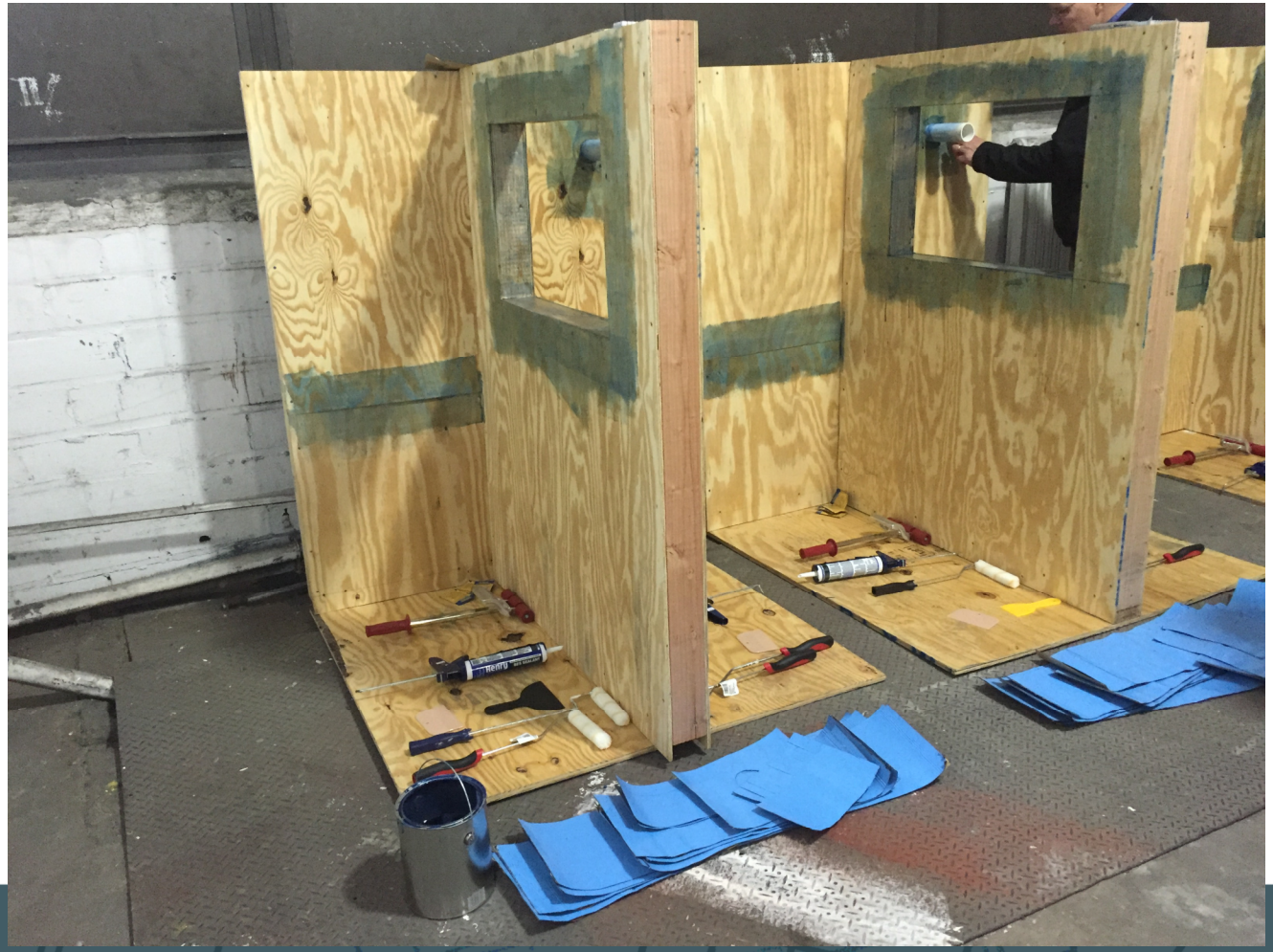
Prepare wall substrates accepting CCW self-adhered flashings with CCW-702, CCW-702 LV, CCW-702 WB, CAV-GRIP or Travel-Tack™ contact adhesive. Prepare cured Barrithane VP membrane accepting CCW self-adhered flashings with CAV-GRIP or Travel-Tack contact adhesive.

Corner treatments shall cover the transition and extend at least 3 inches on each side. Rough opening treatment shall extend 3 inches minimum onto the wall and shall return into the rough opening deep enough to provide continuous seal of the fenestration to the air barrier. Consult Barrithane VP details for more information. All terminating edges of CCW self-adhered flashing shall be covered with a 1" width tooled ribbon of Barribond.

Open pail and apply Barrithane VP using a paint roller or brush. On glass mat faced gypsum, plywood and OSB sheathing substrates, apply in single or mutiple coats as follows: 15-25 mils wet thickness on exterior wood or gypsum sheathing substrates; 30-50 wet mils thickness on concrete or masonry substrates. If multiple coats are used, allow 1st coat to cure firm before applying second. Coat all opaque surfaces and Barribond details. Lap onto 705 FR-A flashing details as shown in Barrithane VP drawings. Provide sufficient coverage for an opaque, pinhole-free coating over all surfaces.



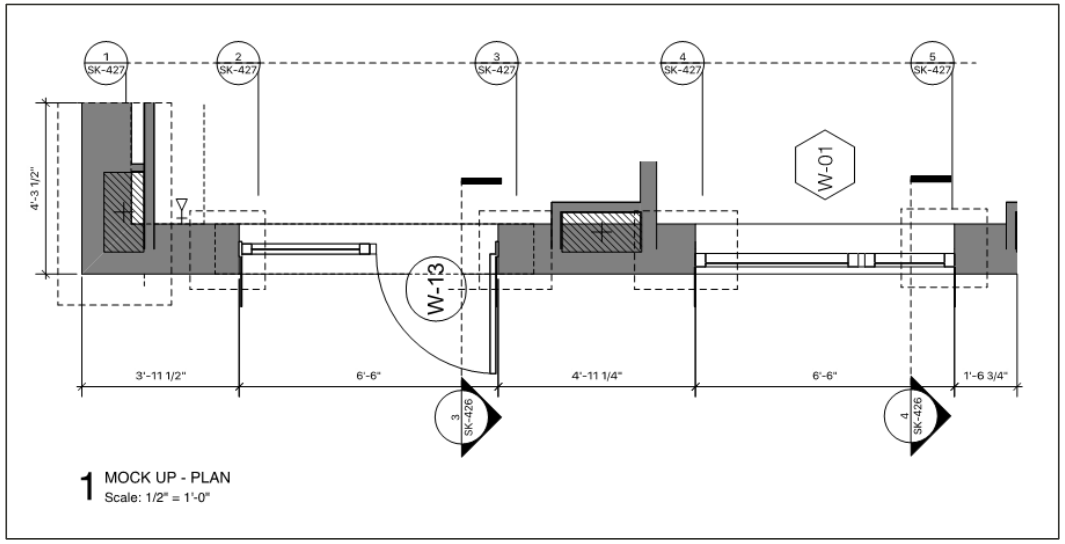
“Uncommon” tools







Mock Ups are Critical

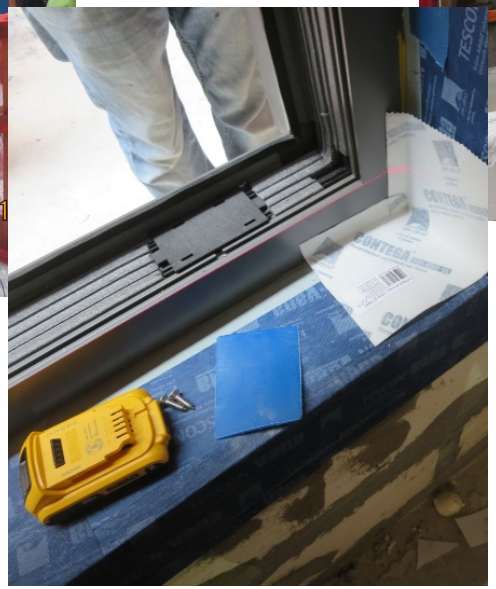


211 W 29th Street - Mockup Vendor Contact List

COMPONENT	CONTACT	NOTES
Cladding: Taktl Panels	Katherine Lynn Design + Applications Consultant, Northeast katherine.lynn@taktl-llc.com T 646·789·5626 | M 609·462·0173 175 Varick Street | New York, NY 10014 taktl-llc.com	Taktl Standard in Platinum - 2 textures, 2 finishes (4 types total)
Rainscreen Attachment: NVELOPE	Dave Sommer (206) 226-2311 cell international@nvelope.us dave@interra-facade.com	NV-1 System
Back Up Wall: Hebel AAC	Ricardo Gomez Director of Operations Telefon +1-2104023223 Mobil +1-2108658620 ricardo.gomez@xella.com Xella Aircrete North America, Inc Sales 900 Schneider Dr. US78108 Cibolo, Texas www.hebel-usa.com	6" Cored AAC and U Block
Sunshade: DAMS Inc	Shawn Bowman, CSI | National Director of Sales and Marketing DAMS Incorporated - D. Architectural Metal Solutions Incorporated 5919 W. 118th St. | Alsip, IL 60803 office: 708-224-4311 | fax: 708-388-9392 | mobile: 708-793-9107 shawn.bowman@damsinc.com | damsinc.com	Custom Extrusion and Flat Plate Aluminum
Windows & Doors: Fentrend	Sean Kennedy, CPHC Supplier/Client Manager sean@fentrend.com // 646.665.1478	One of Three options: Schuco AWS 90SI Zola Alu 90 Aluprof MB104
Door Sill: Alumat	Frank Hegan fhegan@ct-sol.com	Alumat MFAT
Insulation: Roxul (or Thermafiber)	SHAWN TORBERT, LEED AP, CPHD, CSI NY METRO SPECIFICATIONS MANAGER | ROXUL INC. Cell: (732) 887-4079 www.roxul.com	Cavity Rock DD and Comfort Batt

Mock Ups are Critical







Rain Screen







Rain Screen





EIFS





EIFS

XPS EIFS - R 5

System Bulletin

sto

StoTherm® ci XPS Lotusan®

Decorative cladding with continuous air/moisture barrier and continuous insulation for heat, air and moisture control



System Description
StoTherm ci XPS Lotusan is a decorative and protective exterior wall cladding that provides superior air and weather tightness with excellent thermal performance and durability. It incorporates continuous insulation and a continuous air/moisture barrier with Sto's high performance finishes in a fully tested wall cladding assembly.
Uses
StoTherm ci XPS Lotusan can be used in residential or commercial wall construction where energy efficiency, superior aesthetics, air and moisture control are essential. The superior compressive strength and low water absorption of Dow Panel Core 20 insulation make it appropriate for institutional, or other projects where increased durability is desired.

Features	Benefits
Design versatility	Aesthetic and curb appeal easy to achieve
Self-cleaning properties	Reduced maintenance, extended time to recoat
Continuous XPS insulation, R-5 per inch	Increased durability, reduced heating and cooling costs
Quick set adhesive, no mechanical fasteners	Fast installation, no thermal bridging
Continuous air and moisture barrier	Protects against mold and moisture problems
Fully tested compatible components	No experimenting with untested designs
Properties	
Weight (not including sheathing and frame)	< 2 psf (10 kg/m²)
Thickness (insulation)	1 - 6 inches (25-152 mm)
R-value (not including sheathing and frame)	5.0 – 30 ft²·h·°F / Btu (0.88 – 5.28 m²·K / W)
Wind Load Resistance	Tested up to ± 175 psf (8.37 kPa)
Construction Types	I-V, NFPA 285 tested for Types I-IV
Warranty	
15 year Limited Warranty	
Maintenance	
Requires periodic cleaning to maintain appearance, repair to cracks and impact damage if they occur, recoating to enhance appearance of weathered finish. Sealants and other façade components must be maintained to prevent water infiltration.	

Substrate: Glass Mat Gypsum sheathing in compliance with ASTM C 1177, Exterior or Exposure I wood-based sheathing (plywood or OSB), code compliant concrete, concrete masonry, or portland cement plaster, existing structurally sound, uncoated brick or other masonry wall construction.

1)	StoGuard® Air and Moisture Barrier
2)	Sto TurboStick™ Spray Foam Adhesive
3)	Dow STYROFOAM™ Panel Core 20 Insulation Board
4)	Sto Mesh (embedded in Sto Base Coat)
5)	Sto BTS® Xtra Base Coat
6)	Sto Primer Sand (optional)
7)	Sto Textured Finish: Stolit® Lotusan®

DOW

Page 1 of 2

2

CARPENTER
We bring comfort to your life.®

NEOPOR® by BASF

NEOPOR® GPS TECHNICAL PROPERTIES

FOR NORTH AMERICA

Neopor® GPS rigid foam is today's energy-efficient and cost-effective insulation solution for architects, builders and contractors.

Property	Unit	Neopor GPS F5300 Plus
ASTM C578 Classification		Type I
Compressive Resistance	at yields of 10% deformation in psi (min)	10.0
Thermal Resistance	°F -ft² - h/BTU (°C - m²/W) at 75°F	5.0
	°F -ft² - h/BTU (°C - m²/W) at 40°F	5.2
Water Vapor Permeance	Max perm (ng/Pa – s - m²)	4.0
Water Absorption by Total Immersion	Max volume % absorbed	1.1
Flexural Strength	psi	25.0
Density	lbs/ft³ (min)	.90

Please note:
R means resistance to heat flow. The higher the R-value, the greater the insulating power. The technical and physical metrics provided in this table reference values for insulation products made of Neopor GPS. The values and properties may vary depending on how they are processed and produced. The R-Value properties are based on 1-1/16 in thickness.



Brick





Brick





Good Photos

Continuous Tight Insulation: NO GAPS between boards. Well insulated building edge and corners



RIGID INSULATION

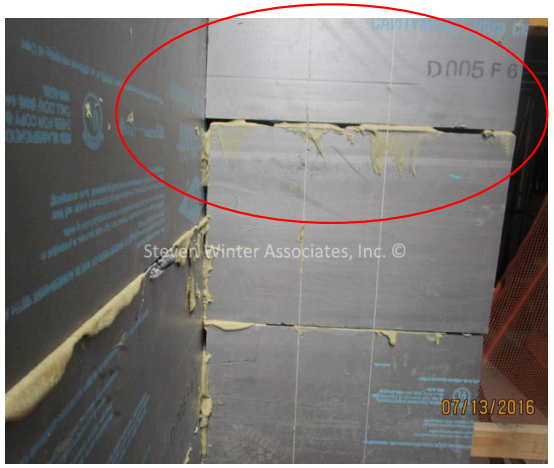




Bad Photos

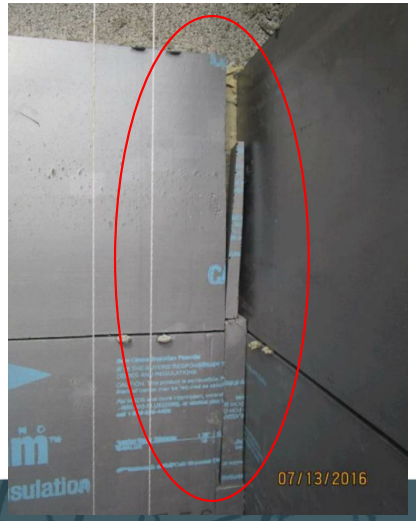


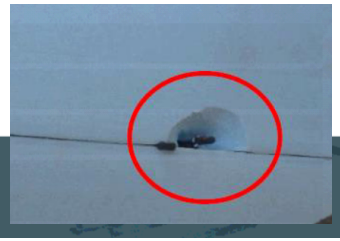




Large Gaps in installation, Insulation removed by brick ties



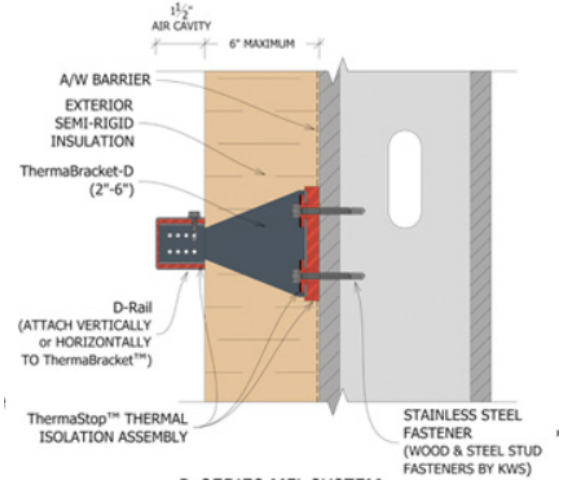






Mineral Wool

Thermally broken rain screen system with steel stud back up wall.









Air Barriers – Fluid Applied

Exterior grade gyp with liquid air barrier (spray, roll, or trowel)





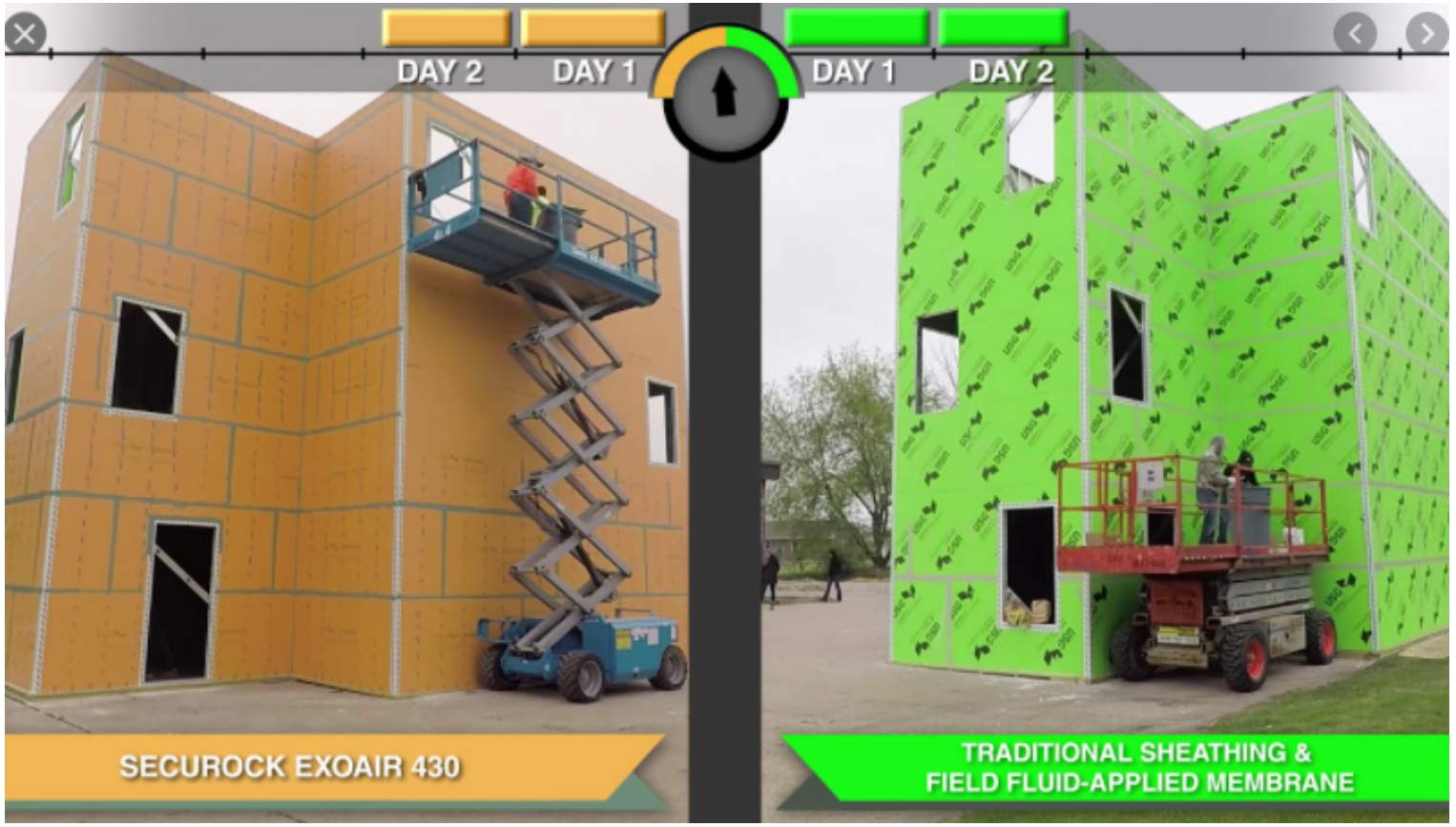
Air Barriers – Sheet Applied

Exterior grade gyp with
sheet membrane air barrier





Air Barriers – Factory Applied



Air Barriers – **CMU**

Air Barrier application on above grade walls best practices:

- CMU's porosity leads to difficult air leakage pathways
- Liquid applied air barrier on the exterior can be highly effective
  - Spray on
  - Rolled on
  - Trowel on



Air Barriers – **CMU**









Roller Applied Air Barrier

Air Barriers – **CMU**







Trowel Applied Air Barrier

Air Barriers – **CMU**

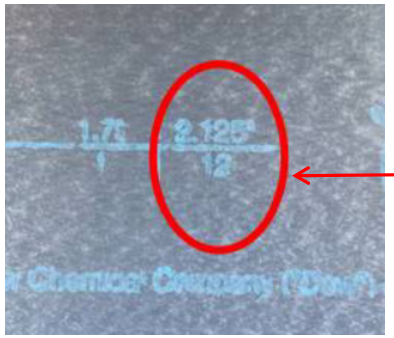




Spray Applied Air Barrier

Air Barrier and Insulation

- Continuous Tight Insulation: NO GAPS between boards. Well insulated building edge and corners.



R-value



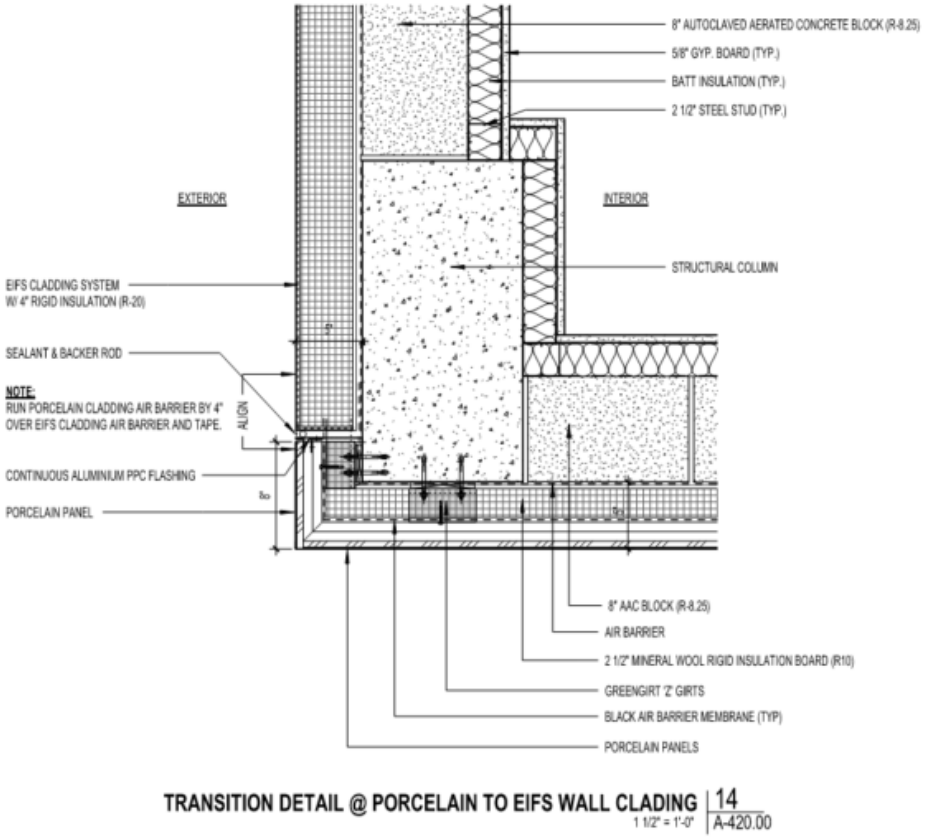
Thickness measure







Air Barrier and Insulation - AAC



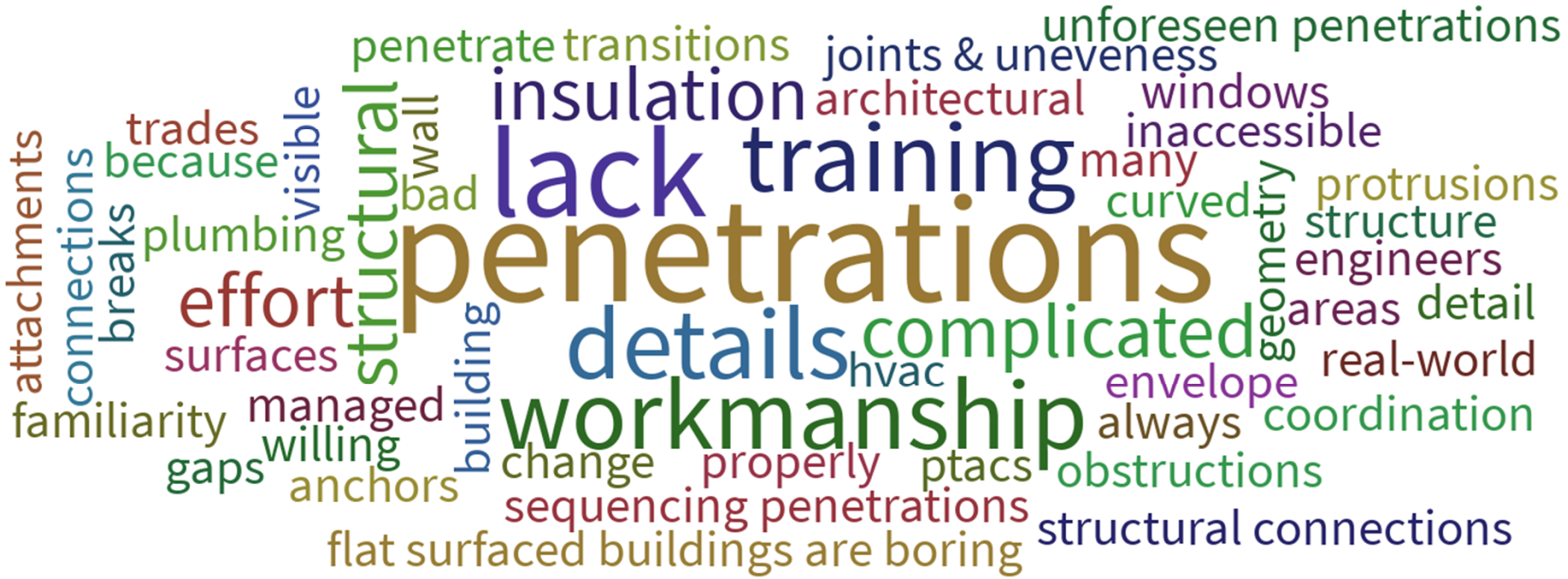
TRANSITION DETAIL @ PORCELAIN TO EIFS WALL CLADING | 14 / A-420.00
1 1/2" = 1'-0"



When poll is active, respond at **PollEv.com/swa335**

Text **SWA335** to **22333** once to join

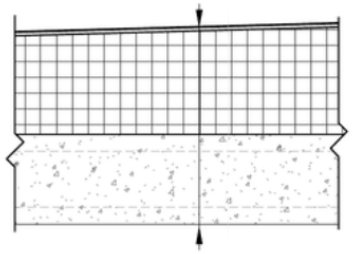
Why do you think continuous insulation is so hard to achieve?



Roofing – Single Ply Membrane

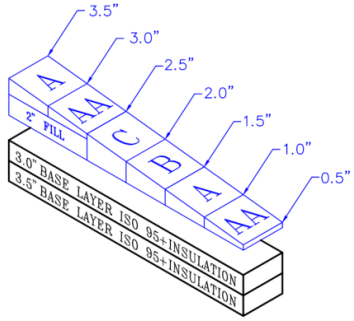
- Roof Membranes with high SRI to comply with energy star
  - Typically TPO membranes
  - EPDM can be found in white Energy Star compliant

ROOF CONSTRUCTION
- FULLY ADHERED ENERGY STAR TPO ROOF MEMBRANE
- R-40 AVG TAPERED POLY ISO INSULATION WITH COVER BOARD, STAGGER SEAMS. 1/8" PER FOOT MAX., MIN. 6" RIGID NSULATION = R-35
- PRECAST CONC SLAB, SEE STRUC DWGS
- SRI 82 OR HIGHER



R-1 TYPICAL ROOF CONSTRUCTION

MATERIAL	THICK (IN.)	R- VALUE	FIRE RATING
POLYISO INSULATION	6"	35	1-HR UL J-994



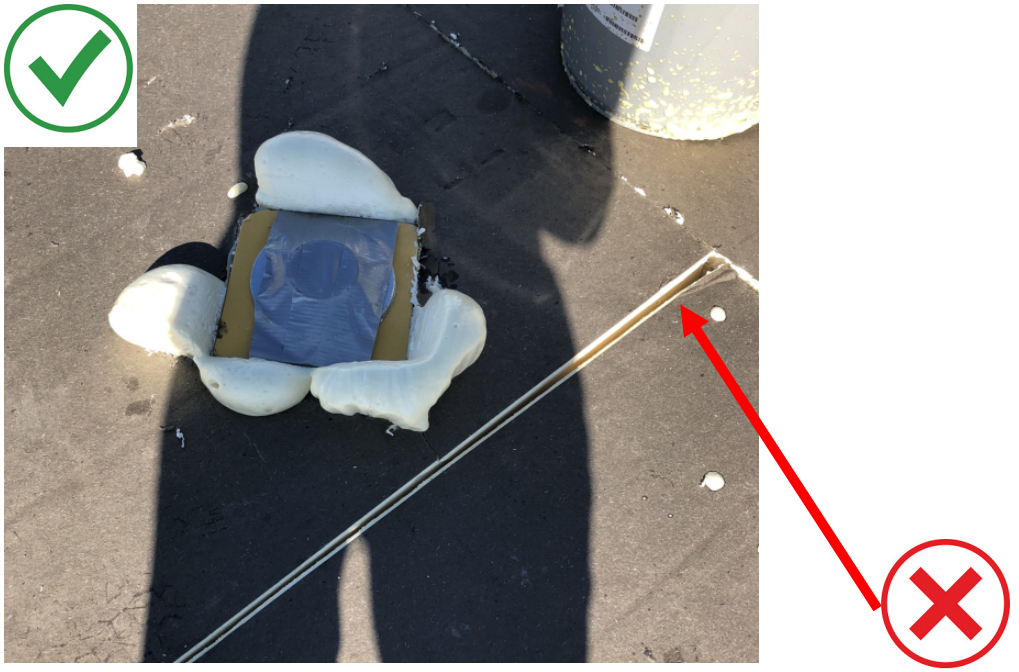
TYPICAL SECTION
1/8"/FT. SLOPE
N.T.S.

MATERIAL:	ISO 95+ GL		
SLOPE:	1/8"/FT	CRICKET SLOPE:	1/4"/FT
MIN. THICKNESS:	7.0"	MAX. THICKNESS:	9.88"
BASE:	3.0", 3.5"	OVERLAY:	NONE
AVERAGE R-VALUE:	51.81	MIN. R-VALUE:	40

Roofing – Single Ply Membrane

- Insulation is continuous, tightly adjoined with staggered seam





Roofing – Built-Up Roofing Systems

- Commonly used across the US for the past 100 years
- Installed by altering layers of asphalt or tar and supported by bitumen fabrics directly over insulation
- Top coat typically consist of gravel which can have a high SRI and provides UV protection



Roofing – Built-Up Roofing Systems

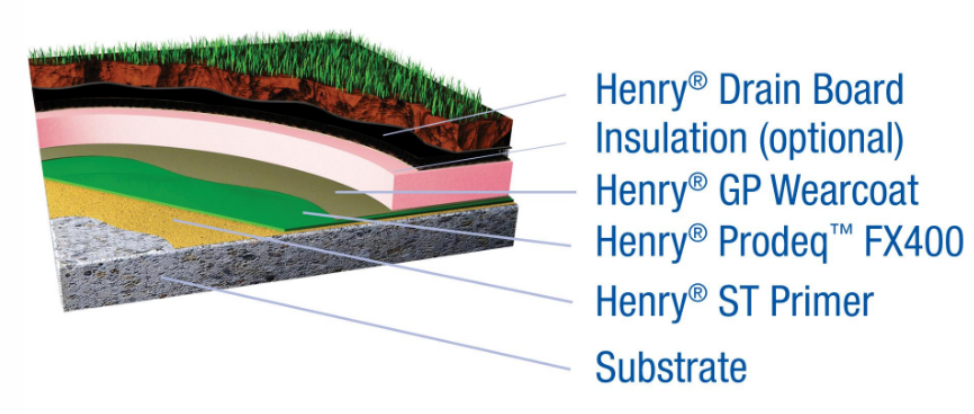




Roofing – IRMA Roofing Systems

IRMA - Inverted membrane roof systems

- Membrane is applied directly to the substrate typically the slab
  - Product example: Henry Prodeq System
- Protects membrane from UV and temperature fluctuations



Roofing – IRMA Roofing System

- Insulation is to be continuous, tightly adjoined with staggered seams





Roofing – IRMA Roofing System

Ballasted IRMA roof

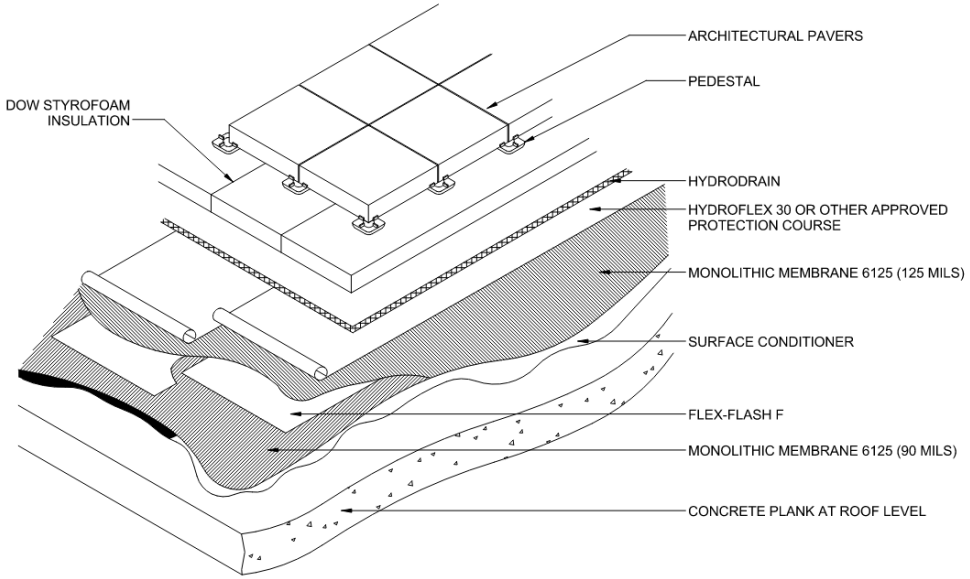
- Insulation is continuous, tightly adjoined layers alternate direction





Roofing – IRMA Roofing System



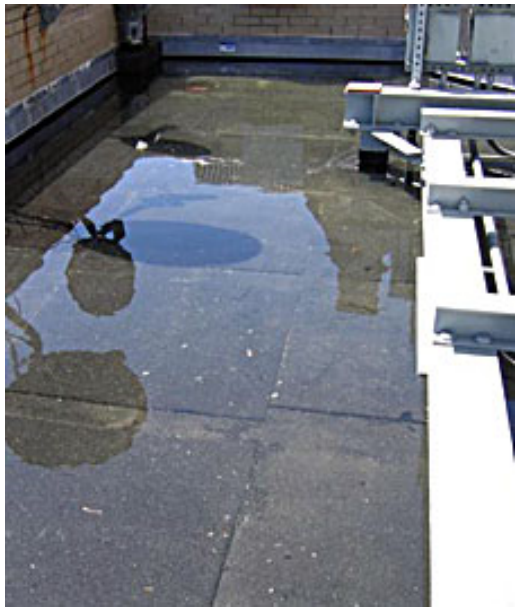


A1 / A-331 Hydrotech - Roof Axonometric
NTS

Roofing Integrity Testing

Flood testing procedure for low sloping flat roofs

- After roof membrane is applied and before insulation is installed
- Roof drains temporarily sealed
- Flood roof with a minimum of 2” of water for 12 - 48 hours
- Visually inspect underside of the test area for water leaks and evidence of water infiltration
- This is the simplest testing method available



Spray Foam – Installation

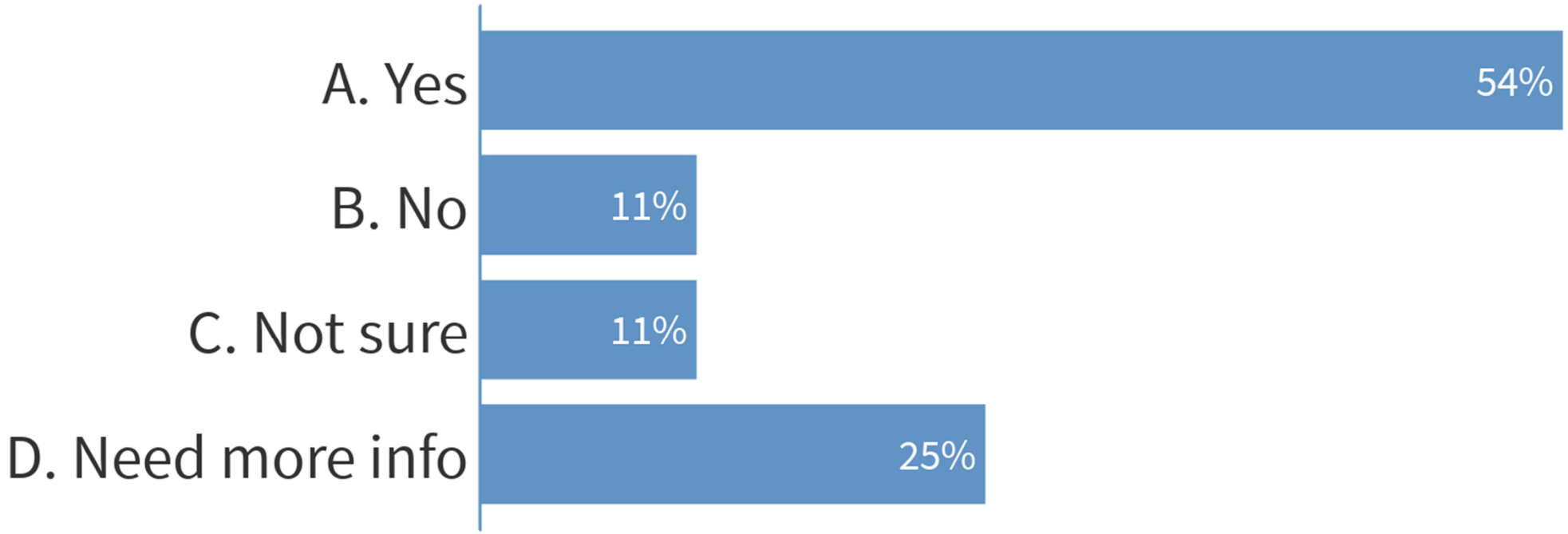
- Challenging details must be carefully and systematically addressed by spray foam installer
  - Spray foam is not a bulletproof approach to air sealing
- Installed at minimum thicknesses indicated on drawings & continuously



When poll is active, respond at **PollEv.com/swa335**

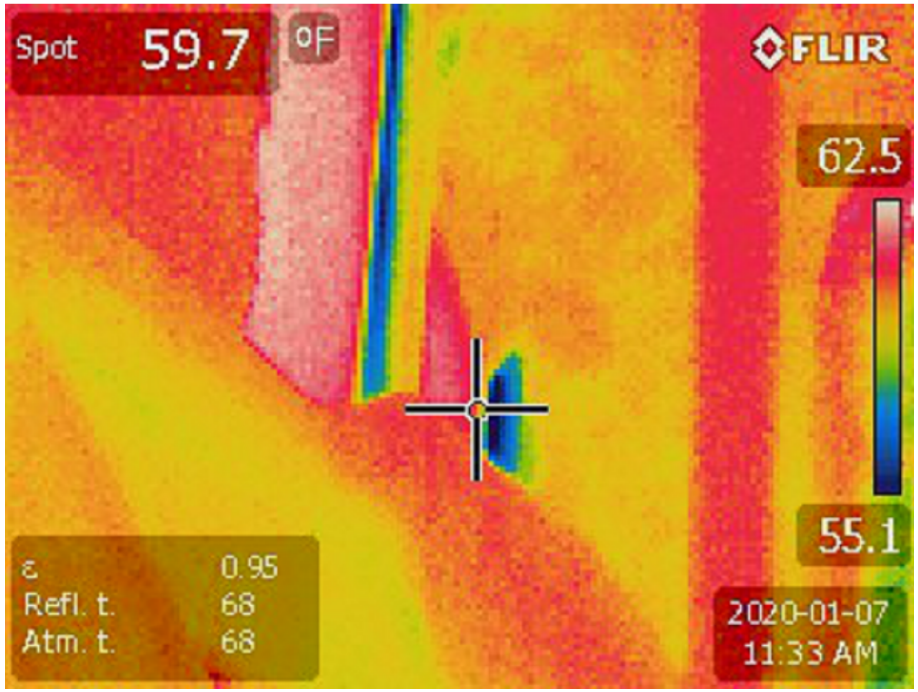
Text **SWA335** to **22333** once to join

Are you concerned with the global warming potential of spray foam?



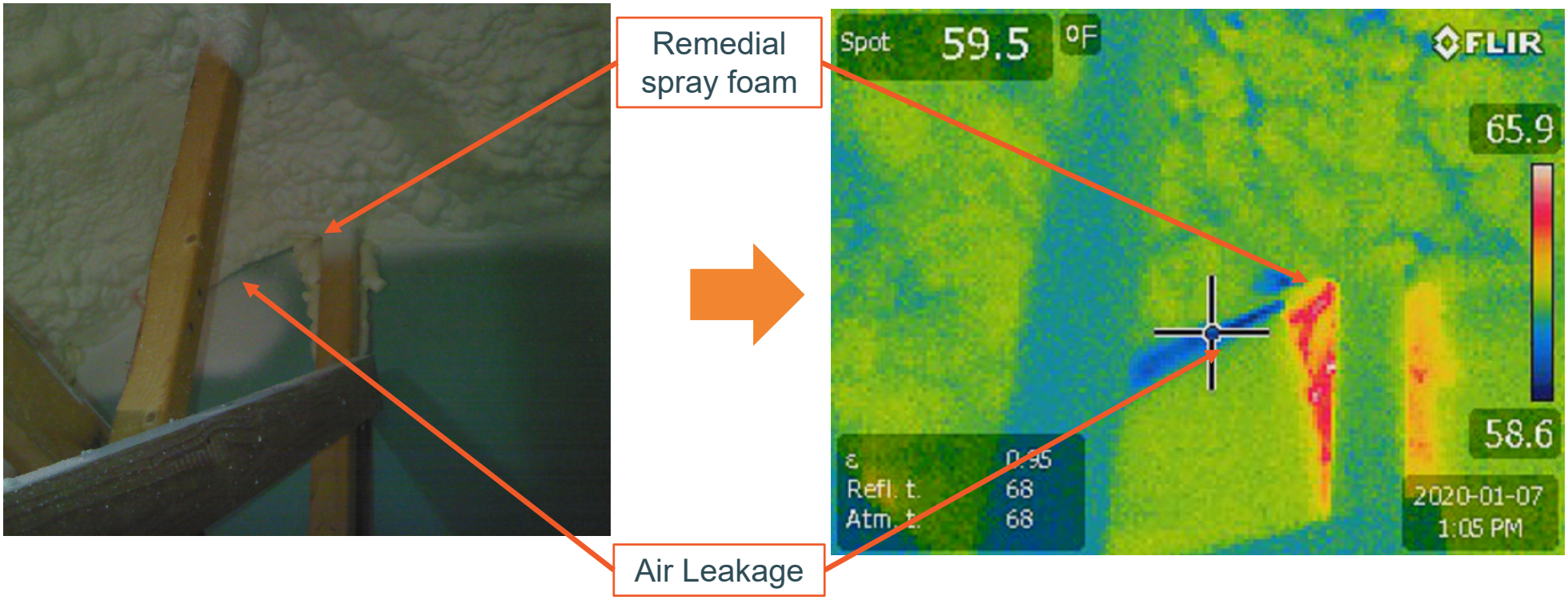
Spray foam – Challenging Details





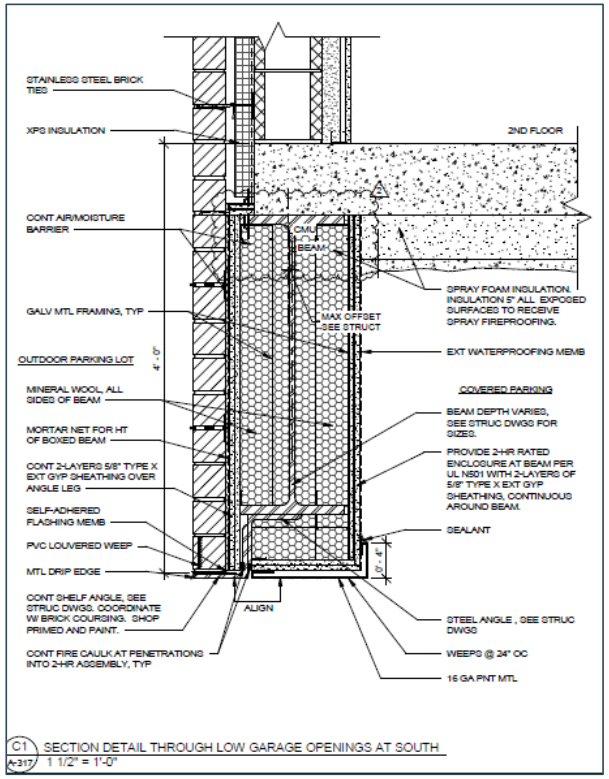
During final whole building blower door IR images show air leakage where spray foam is missed.

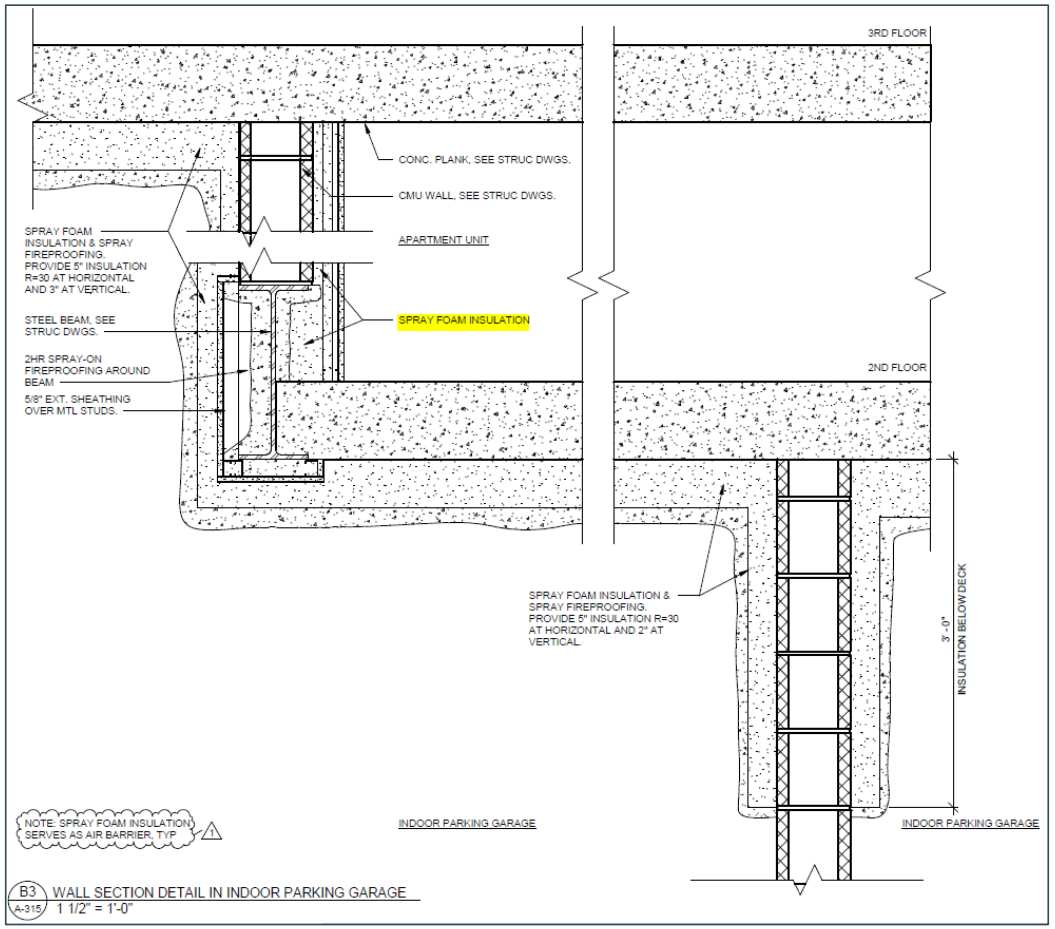
Spray foam – Challenging Details



During final whole building blower door IR images show air leakage where spray foam is missed.

Spray foam details





Spray Foam Coverage







High Performance Walls

CLADDING ATTACHMENT SYSTEMS AND THEIR IMPACT ON CONTINUOUS EXTERIOR INSULATION EFFICIENCY

Document Summary: This document is meant to serve as a guide for designers and builders to compare the thermal performance of different cladding attachment systems. The first section is a catalogue of products, split into brick veneer and cladding finish systems. The second section presents thermal modeling results of these systems from a study conducted by Steven Winter Associates (SWA).

Thermal Efficiency: percentage of continuous insulation R-value that is effective.

- **100%** thermal efficiency = continuous insulation without thermal bridging
- **20%** thermal efficiency = continuous insulation derated to 20% of installed R-value

Thermal Mitigating Products

For Cladding Finish Systems

Girts
- Fiberglass Girts
- Thermoset Resin

Clips
- Stainless Steel Clips
- Aluminum Clips
- Fiberglass Clips
- Thermal Stop Clips

For Brick Veneer Systems

Ties
- Stainless Steel Brick Ties
- Thermal Break Brick Ties
- Basalt Fiber Wall Ties
- Connectors

Angles
- Stand-off Shelf Angle
- Shelf Angle with Thermal Break

Alternative Systems: Structural & Finish

Assembly Systems
- Standard Assembly: CMU & Brick
- Masonry Veneer System
- EIFS Finish Assembly
- ICF System
- Insulated CMU
- Autoclaved Aerated Concrete (AAC)
- Structurally Insulated Panels (SIPs)

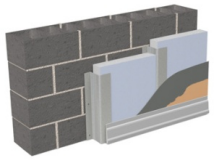
Miscellaneous Thermal Mitigating Products

Various
- Fluid-Applies
- Gravel

Load bearing
- High Density EPS
- Column Bearing Blocks
- Fiberglass Thermal Break

For Cladding Finish Systems: Girts

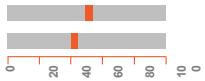
Galvanized Girts



Description

Typical z-girts are usually galvanized steel. Most projects use these to support their cladding systems.

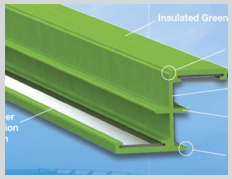
Thermal efficiency per SWA: **43%-53%**



53% for Steel backup
43% for CMU backup

Standard Product

Fiberglass Girts



Description

Fiberglass girts are installed and used the same way as typical metal z-girt. The fiberglass material reduces thermal bridging.

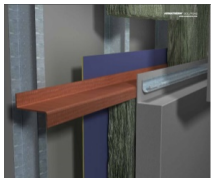
Thermal efficiency per SWA: **91%-95%**



91% for Steel backup
95% for CMU backup

Example Products:
Green Girt- Simple Z

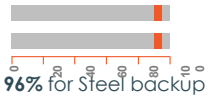
Thermoset Resin Girts



Description

These girts have a low thermal conductivity. Made of fire resistant resin material. Can be spaced 16" or 24" o.c. and is very strong.

Thermal efficiency per SWA: **96%**

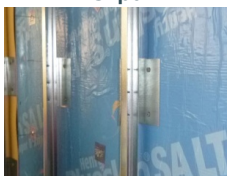


96% for Steel backup
96% for CMU backup

Example Products:
Armatherm Z Girt

For Cladding Finish Systems: Clips

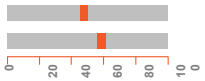
Galvanized Metal Clips



Description

These clips are usually galvanized steel and are used to support rainscreen and panel cladding systems.

Thermal efficiency per SWA: **46-59%**



46% for Steel backup
59% for CMU backup

Standard Product

Stainless Steel Clips



Description

Replacing galvanized steel clips with stainless steel ones can greatly reduce the thermal conductivity.

Thermal efficiency per SWA: **63-74%**



63% for Steel backup
74% for CMU backup

Example Products:
A-Clip. MFSSCHAN

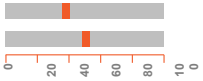
Aluminum Clips



Description

Aluminum clips are light weight and strong. They are a more elastic and non corrosive alternative to traditional metal clips.

Thermal efficiency per SWA: **38-52%**



38% for Steel backup
52% for CMU backup

Example Products:
Alpha Brackets

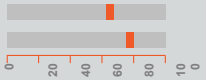
Fiberglass Clips



Description

Fiberglass clips have a much lower thermal transmittance coefficient than any metal equivalent.

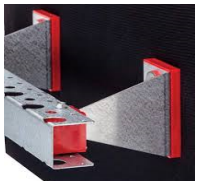
Thermal efficiency per SWA: **64-79%**



64% for Steel backup
79% for CMU backup

Example Products:
Cascada Clip

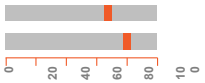
Thermal Stop Clips



Description

This clip has a plastic thermal stop at the base and head to help mitigate thermal bridging.

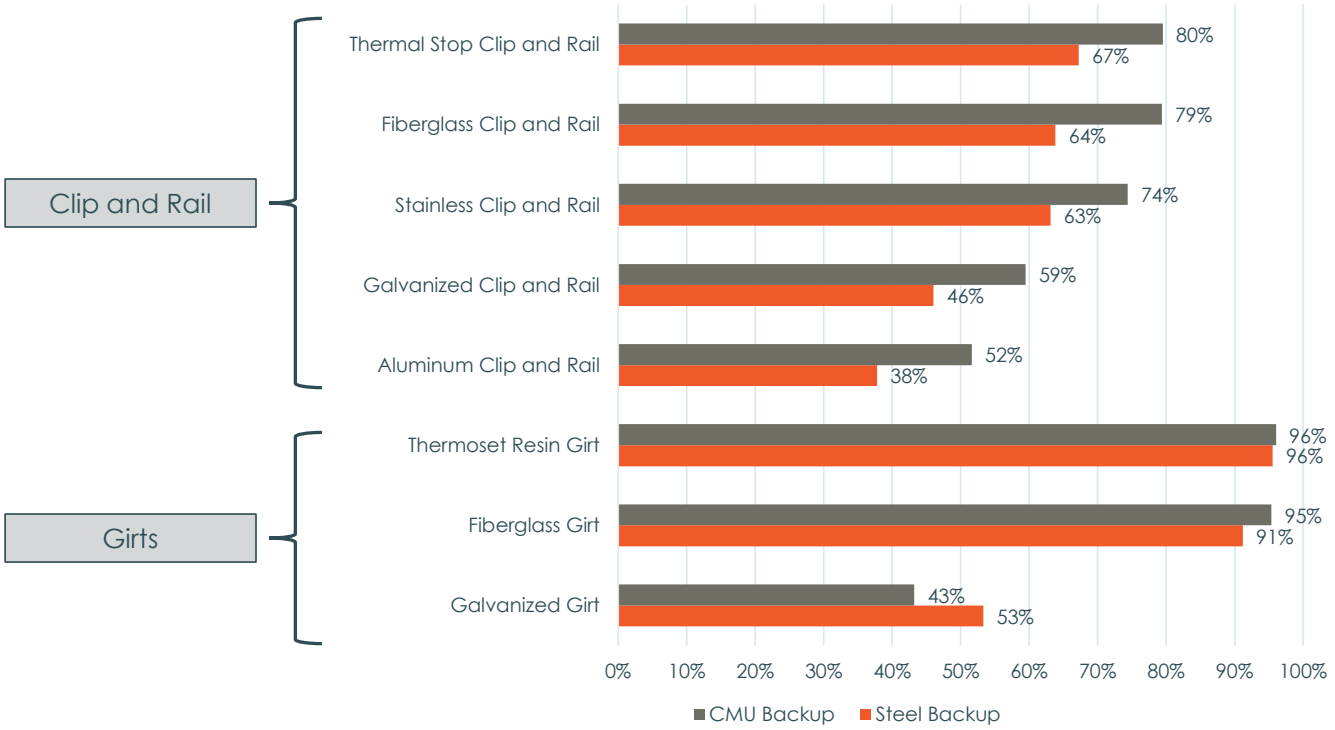
Thermal efficiency per SWA: **67-80%**



67% for Steel backup
80% for CMU backup

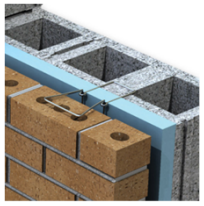
Example Products:
Pos-I-Tie Thermal Clip, Nvelope NV1 Thermal Clip

Results: Panel Cladding



For Brick Veneer Systems: Ties

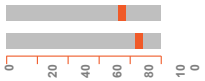
Galvanized Steel Brick Ties



Description

Typical brick ties are galvanized steel. Most brick veneer projects use this type of product.

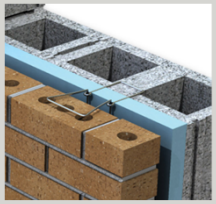
Thermal efficiency per SWA: **75-84%**



75% for Steel backup
84% for CMU backup

Standard Product

Stainless Steel Brick Ties



Description

Stainless steel ties are less conductive than galvanized steel ties.

Thermal efficiency per SWA: **87-93%**



87% for Steel backup
93% for CMU backup

Example Products:
2 Seal Tie Thermal, Original Pos-I-Tie

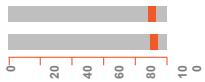
Thermal Break Brick Ties



Description

This stainless steel brick tie has a plastic coating, which reduces thermal bridging.

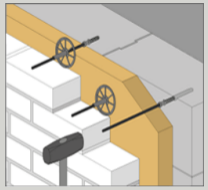
Thermal efficiency per SWA: **88-94%**



88% for Steel backup
94% for CMU backup

Example Products:
2 Seal Tie Thermal Wing Nut Anchor

Basalt Fiber Wall Ties



Description

Basalt fiber is a material made from fine fibers of basalt. They tend to be stronger and lighter than stainless steel wall ties and much less thermally conductive.

Example Products:
Teplo Ties, Galen Wall Ties

Connectors



Description

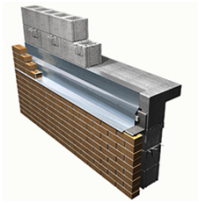
These are used in place of brick ties. The combination of horizontal and vertical elements increases strength despite its small size.

These can be applied prior to liquid applied air barrier installation, so air tightness is improved.

Example Products:
Block Shear Connector

For Brick Veneer Systems: Angles

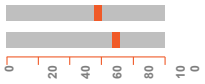
Typical Shelf Angle



Description

Typically, shelf-angles are made of galvanized steel.

Thermal efficiency per SWA: **58-69%**



58% for Steel backup
69% for CMU backup

Standard Product

Stand-off Shelf Angle



Description

This stand off shelf angle allows insulation to be installed behind it. The bracket can be used with readily available shelf angles.

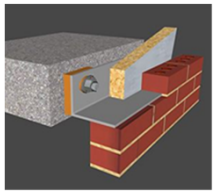
Thermal efficiency per SWA: **73-81%**



73% for Steel backup
81% for CMU backup

Example Products:
FAST (Fero Angle Support Technology),

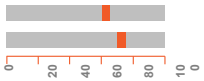
Shelf Angle with Thermal Break



Description

The thermal break plate is installed between the shelf angle and bracket to reduce the thermal bridge at those points.

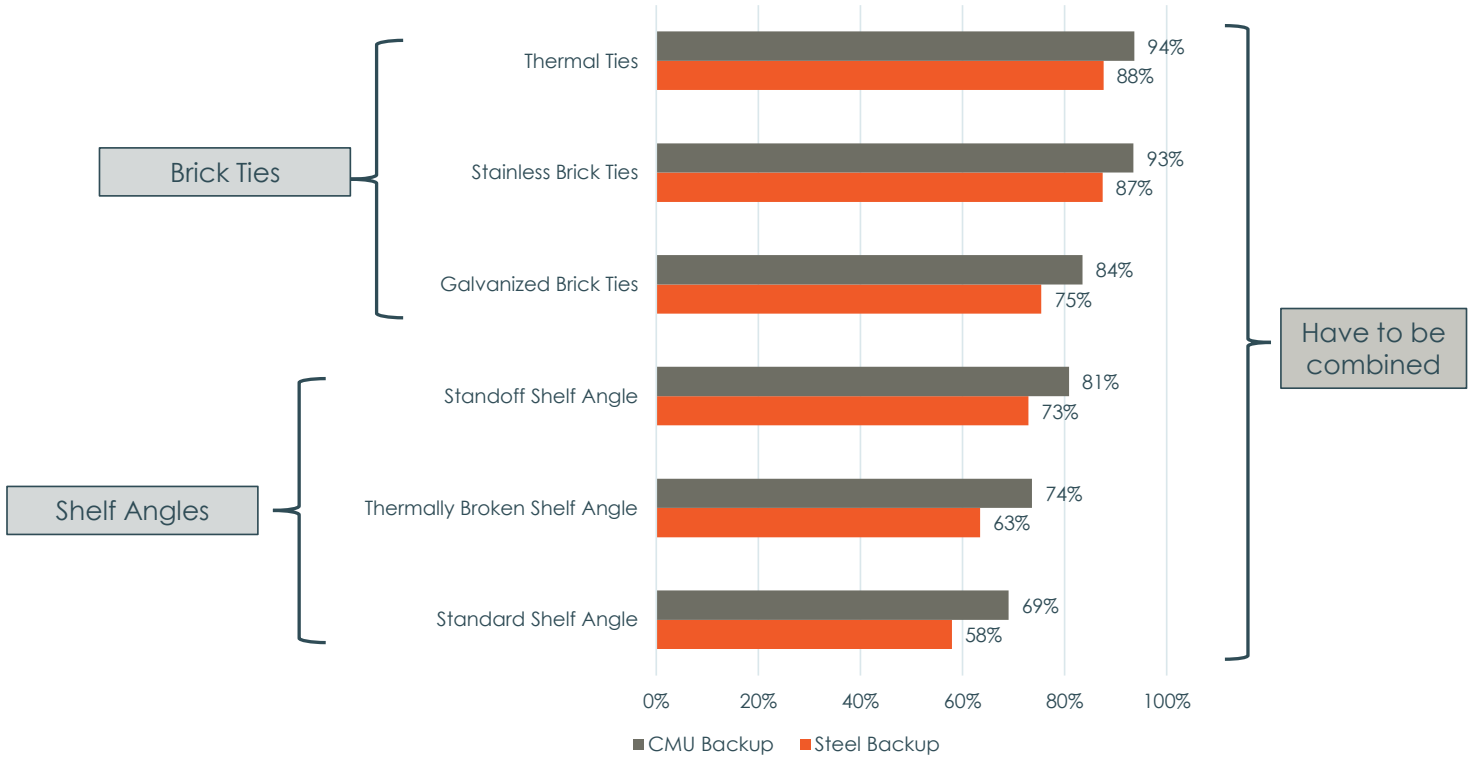
Thermal efficiency per SWA: **63-74%**



63% for Steel backup
74% for CMU backup

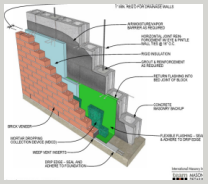
Example Products:
Armatherm Shelf Angle

Results: Brick Veneer



Alternative Systems: Assembly Systems

Standard Assembly : CMU & Brick



Description

A typical CMU wall assumed consists of:

- Brick veneer
- Brick ties
- Shelf angle
- Air gap
- 2.125" XPS insulation (R-12)
- Air barrier
- CMU wall
- Gypsum board

Standard Assembly

Masonry Veneer System



Description

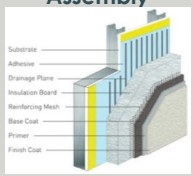
Continuous rigid insulation with a high R-value and polyurethane foam sprayed in between the studs.

Only for steel stud construction – insulation acts as sheathing.

Can be used with any type of cladding.

Example Products:
Thermax System, PAREX: MVS-CI

EIFS Finish Assembly



Description

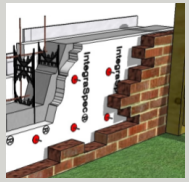
Continuous insulation: do not need cladding supports, brick ties, or shelf angles.

Quick to install and moisture resistant.

Example Products:
StoTherm System, Finestone EIFS, Senergy EIFS, EIFS (CI)

Alternative Systems: Assembly Systems

ICF System
(assuming brick veneer)



Description

Continuous EPS insulation on both exterior and interior of wall , except at floor slab edges.

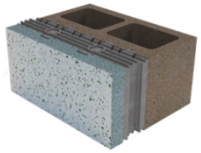
Excellent air tightness results.

An additional option is Sto ICF finish, a cladding layer insulation.

Can be used with any type of cladding.

Example Products:
Vertical ICF Wall System, Strong 3" Ultra ICF, Fox Blocks, NUDURA ICFs, BuildBlock, LOGIX ICF, Vertical ICF

Insulated CMU
(with veneer finish)

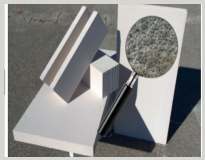


Description

A complete thermally broken insulated masonry system. Includes a pre-assembled structural masonry unit, molded EPS insulation insert and thin veneer face, all connected by internal stainless steel metal anchors. Grouted connection from CMU to CMU but insulation remains continuous.

Example Products:
InsulTech

Autoclaved aerated concrete



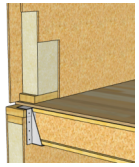
Description

This lightweight masonry material has closed air pockets, improving the R-value of the structure.

There is less embodied energy than standard concrete and CMU products.

Example Products:
AERCON

Structural Insulated Panels (SIPs)



Description

Pre-assembled panels consisting of an insulating foam core sandwiched between two structural facings – typically oriented strand board or metal panels.

SIPS mitigate thermal bridging by wrapping the building in a continuous thermal enclosure with little to no structural penetrations.

Example Products:
Wide range of manufacturers for wood and metal SIPs

Miscellaneous Thermal Mitigating Products: Various

Fluid-Applied

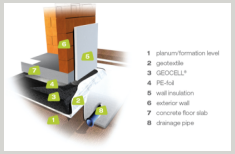


Description

This thermal break material is unique because it is painted on. It can be applied directly to steel to reduce condensation and provide a thermal break.

Example Products:
AEROLON

Glass Gravel



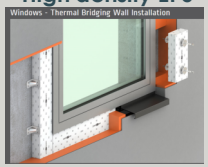
Description

This eliminates thermal bridging below grade as well as water condensation. The product can bear load.

Example Products:
GEOCELL foam glass gravel

Miscellaneous Thermal Mitigating Products: Load Bearing

High density EPS



Description

Has R value of about 3. Product is vapor permeable, lightweight, moisture resistant, and load bearing.

Example Products:
COMPACFOAM

Column Bearing Blocks

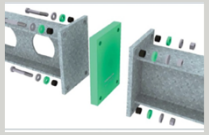


Description

These blocks can supports heavy loads and provides continuous insulation. They can be custom cut and pre-drilled.

Example Products:
STYROFOAM Brand High Load

Fiberglass Thermal Break



Description

Thermal break pads and connections are placed between the structural connections.
This can prevent thermal bridging.

Example Products:
Fabreeka; Schock Isokorb

Poured Concrete Thermal Break



Description

Blocks of thermal break material with rebar incorporated in them provide a structural thermal break for poured concrete balconies, parapets, or slab edges.

Example Products:
Schock Isokorb

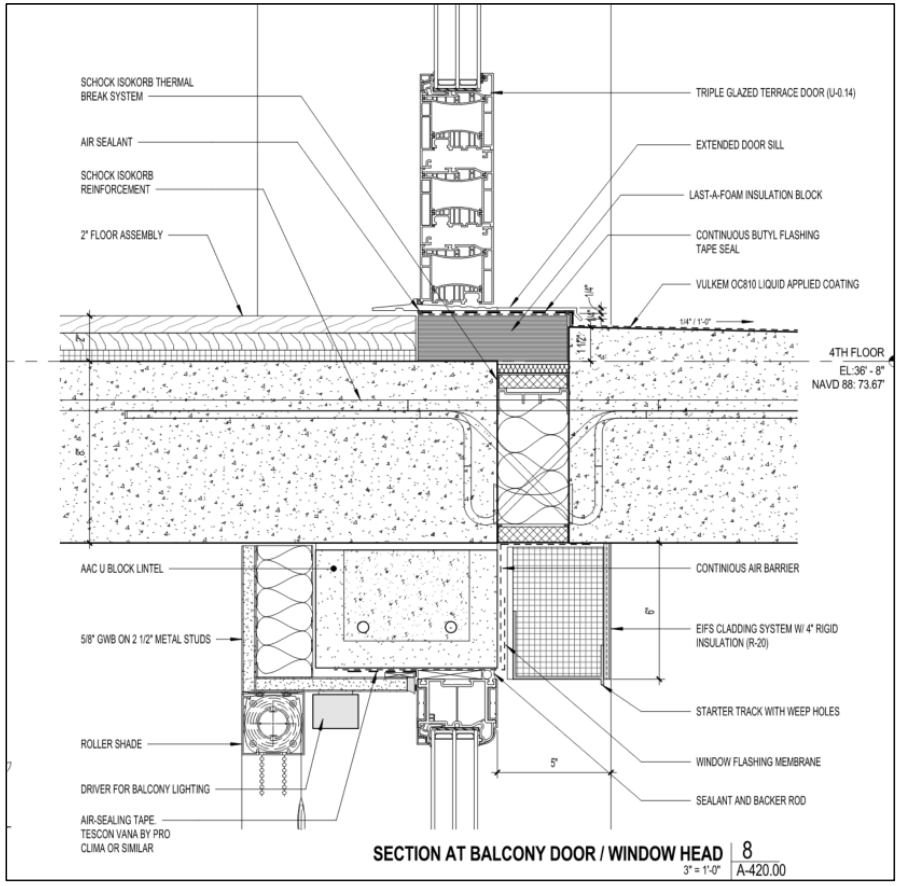
Questions?



5 Minute Break

New and Innovative PH Components

Schock Isokorb





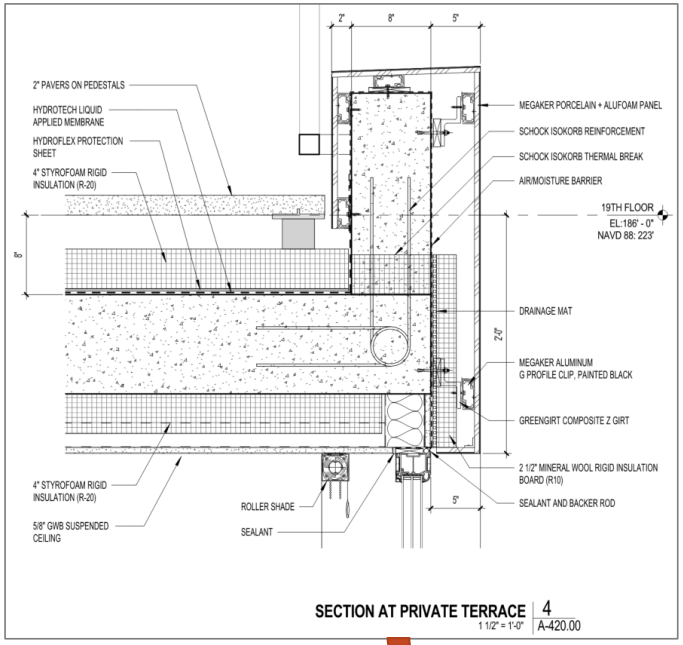
Schock Isokorb







Schock Isokorb







Specialty Products - Subframing





Thermally Improved Attachments



The Thermal 2-Seal™ Wing Nut Anchor is an innovative single screw veneer tie for metal stud construction, it features a dual-diameter barrel with factory-installed EPDM washers to **seal both the face of the insulation and the air/vapor barrier,** and unique Thermal Wings that are **designed to decrease thermal transfer through rigid insulation.**

- The projecting Thermal Wings:
  - Are made from steel encapsulated in plastic to create a thermal break, the plastic is highly flame resistant
  - Accept a 2X-HOOK™ or Seismic 2X-HOOK™ and spin to easily orient pintles/hooks parallel to masonry joints
  - Up to 1/2" of inward adjustability to account for variations in wall thickness
- **H&B's Stainless Steel barrels have *one-third* the thermal conductivity of carbon steel barrels and *one-seventh* the thermal conductivity of the zinc barrels of our competitors products** *(refer to chart below)*

Metal Type	Thermal Conductivity (W/cm K)
Stainless Steel (Type 304)	**0.15**
AISI-SAE 1020 (Plain Carbon Steel)	0.52
Zinc (Commercial)	1.1

References:

- ASM Metals Reference Book, Second Edition, American Society for Metals, Metals Park, OH, 1983.
- Lynch, C. T., CRC Practical Handbook of Materials Science, CRC Press, Boca Raton, FL, 1989.
- Shackelford, J. F., and Alexander, W., CRC Materials Science and Engineering Handbook, CRC Press, Boca Raton, FL, 1991.

- Made with a 5/16" hex head, install with a standard hex socket
- Adaptable for seismic zones with the simple addition of 9 gauge or 3/16" continuous wire and a 2X-HOOK™ Seismic Pintle (SH)

Thermally Improved Attachments







Products Applied – Armatherm 500

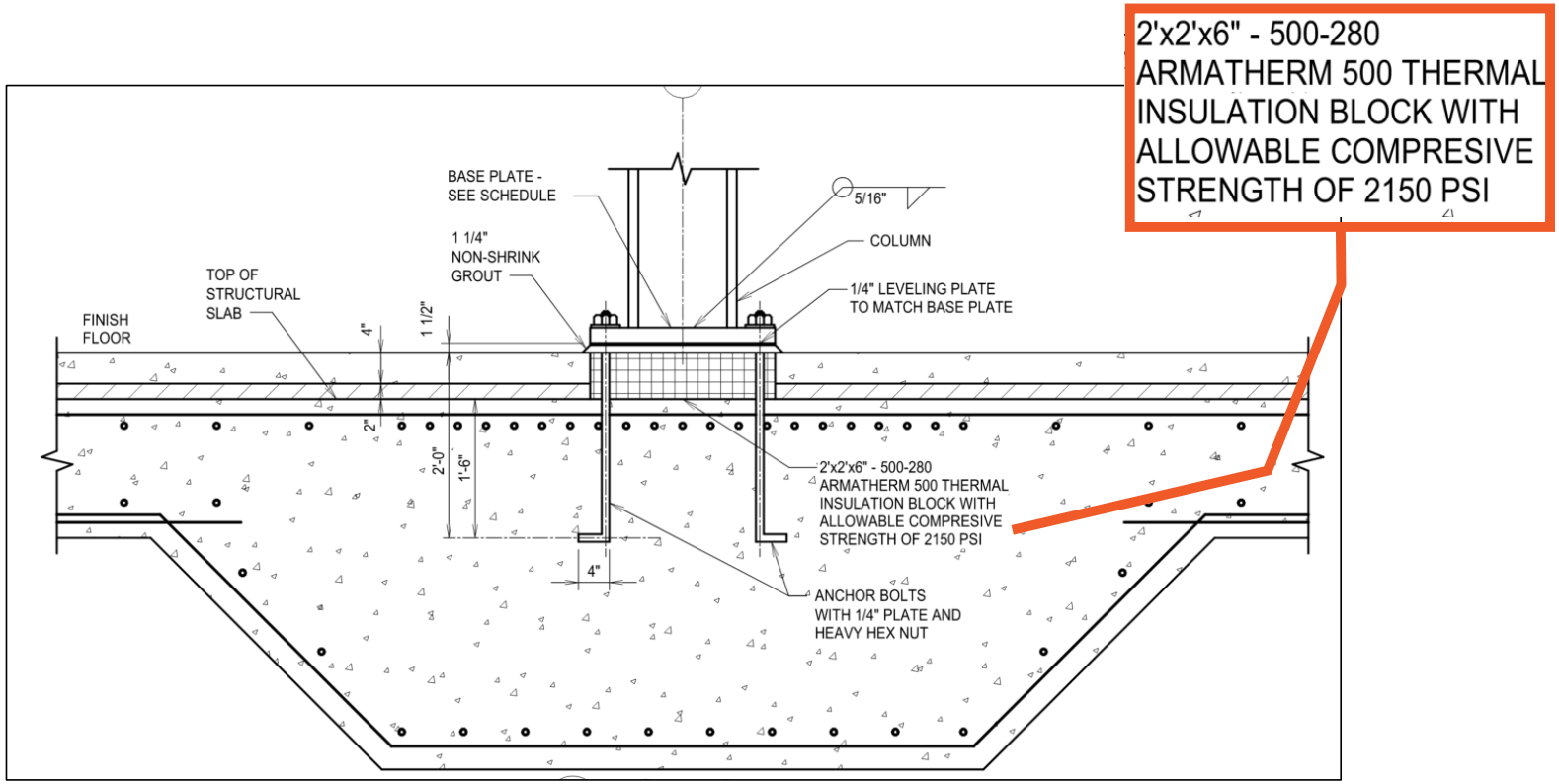
- Armatherm™ 500 is a high strength, closed cell polyurethane material made in several densities to support a wide range of loading conditions.



Specifications Armatherm™ 500	500-150	500-200	500-280
Compressive Stress (psi)	560	1100	2150
Compressive modulus (psi)	18,130	29,000	49,300
Thermal Conductivity (BTU in/hr ft2 F)	0.32	0.39	0.53
R value per inch	3.1	2.6	1.9
Operating Temperature		-300F/+175F	

https://www.armatherm.com/wp-content/uploads/2017/03/Armatherm500USA.pdf

Products Applied – Armatherm 500

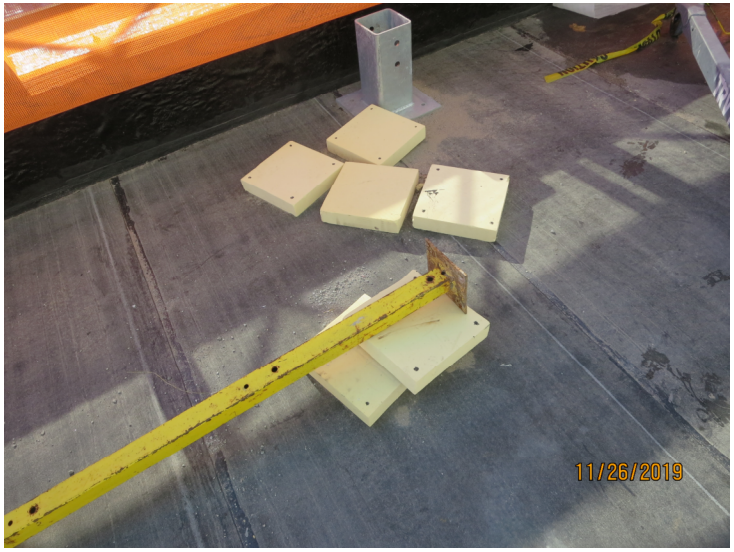


Products Applied – Armatherm 500





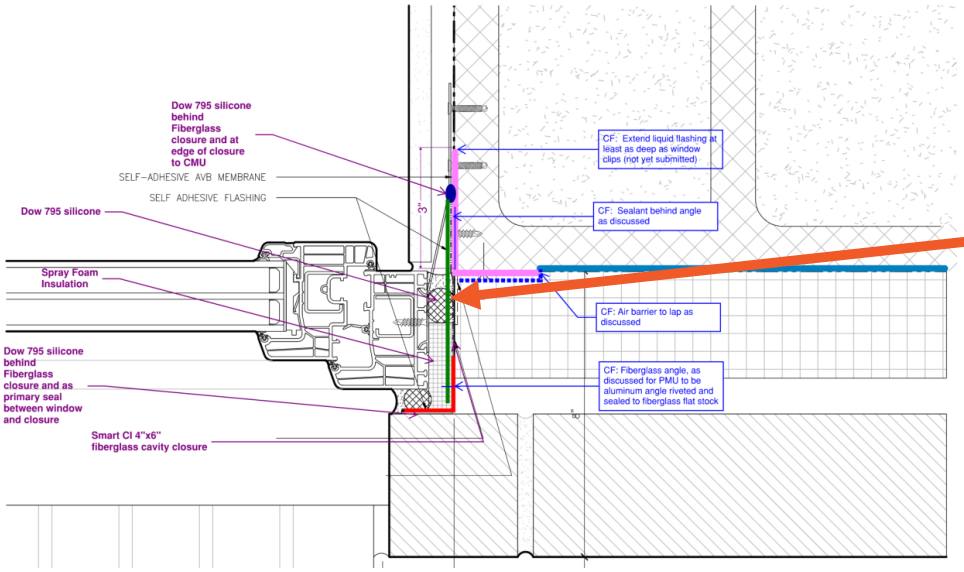
Products Applied – Armatherm 500







Products Applied – Smartci Trim







Products Applied – EIFS + GPS Insulation

Typical EPS insulation board in the EIFS substituted with Neopor GPS insulation board (BASF product).

GPS - graphite polystyrene – comprised of small pockets of air within a polymer matrix. Graphite reflects radiant heat energy increasing R-value

R-value slightly better in cold conditions

R-3.85 (EPS) vs 4.7 (GPS) per inch





1)	Substrate: Glass Mat Gypsum sheathing in compliance with ASTM C 1177, concrete or concrete masonry.
2)	StoGuard® Air and Moisture Barrier
3)	Three adhesive options: Sto TurboStick™, Sto BTS® Plus, or Sto BTS Xtra
4)	Sto EPS Insulation Board
5)	Sto Mesh (embedded in Sto base coat)
6)	Three base coat options: Sto BTS Plus, Sto BTS Xtra, or Sto RFP
7)	Sto Primer (optional)
8)	Sto Textured Finish: Stolit® Lotusan®

When poll is active, respond at **PollEv.com/swa335**

Text **SWA335** to **22333** once to join

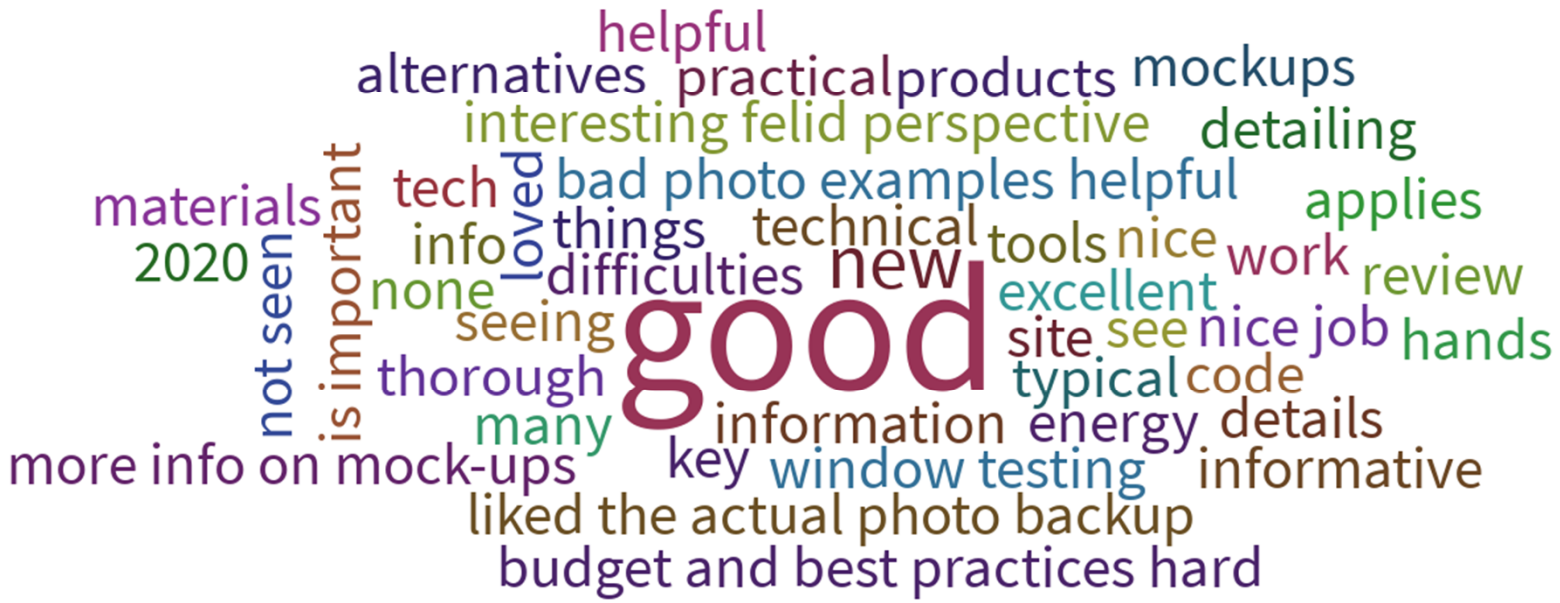
Which of these or other products have you seen starting to be used on projects?



When poll is active, respond at **PollEv.com/swa335**

Text **SWA335** to **22333** once to join

What are your final thoughts & takeaways from the presentation today?



Questions & Final Discussion



Join Us for More Trainings!

- **Module 8.2 -** Net Zero Mechanical, Electrical, and Plumbing
- **Module 8.3** - QA/QC Techniques for Ensuring Success
- **Module 8.4** - Field Training & Mock-Ups

Register here: https://www.newpaltz.edu/sustainability/view-programs-and-progress/zero-net-carbon-training/workshop-schedule-registration--details/

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Resources

- https://www.imiweb.org/masonry-detailing-series-4/
- https://foursevenfive.com/content/product/smart_enclosure/metal_frame/475_Metal_Frame_eBook_Nov_2019_Spread.pdf
- https://foursevenfive.com/masonry-retrofit/
- https://greenerworldsolutions.com/coatings/weather-barrier-systems/
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- https://www.swinter.com/about-us/news/news-item/high-performance-walls-guide/