
abaa2024 building enclosure conference
Building Enclosure Vulnerabilities in Commercial Construction
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Building Enclosure Vulnerabilities in Commercial Construction

Given ever increasing performance demands of commercial building enclosures, combined with increasingly sophisticated installation and tie-in details, careful scrutiny is required to mitigate vulnerabilities that can contribute to long-term recurring performance issues such as air and water leakage, condensation, and thermal inefficiencies.

This presentation will utilize case studies to explore common building enclosure vulnerabilities in commercial construction and proactive mitigation measures based on our design consulting and construction administration experience as well as our experience investigating building enclosure failures.

Sarah Rentfro, P.E.

Sarah Rentfro is a Senior Consulting Engineer in Simpson Gumpertz & Heger Inc.'s (SGH) Building Technology group. She specializes in the design and integration of complex building enclosure systems including roofing, waterproofing, air/water barriers, cladding assemblies, and fenestration with an emphasis on performance efficiency and constructability. She is also actively engaged in SGH's Building Science practice group. Her work includes new design consulting, construction administration, and investigation and rehabilitation of existing building enclosures.

Sierra Stewart, P.E.

Sierra Stewart joined Simpson Gumpertz & Heger Inc.'s (SGH) Building Technology group in 2020. Her experience includes work related to new design consulting, construction administration, and investigation and rehabilitation of existing building enclosures. Her work includes an emphasis on integration of building enclosure systems including roofing, waterproofing, air/water barriers, contemporary cladding assemblies, and fenestration.

Learning Objectives

1. Identify common construction vulnerabilities that contribute to commercial building enclosure performance issues and failures.
2. Develop an understanding of proactive construction administration measures to alleviate risks of commercial building enclosure failures.
3. Understand how interactions between building enclosure systems and associated sequencing and trade coordination can impact commercial building enclosure performance.
4. Recognize QA/QC procedures and tools that are critical to installation, workmanship, and successful commercial building enclosure performance.

Note: Photos and graphics that include manufacturer's names are for example only.

Agenda

- Background and Significance
- Common Construction Vulnerabilities
- Proactive Management of Building Enclosure Quality
- Q&A

BACKGROUND AND SIGNIFICANCE

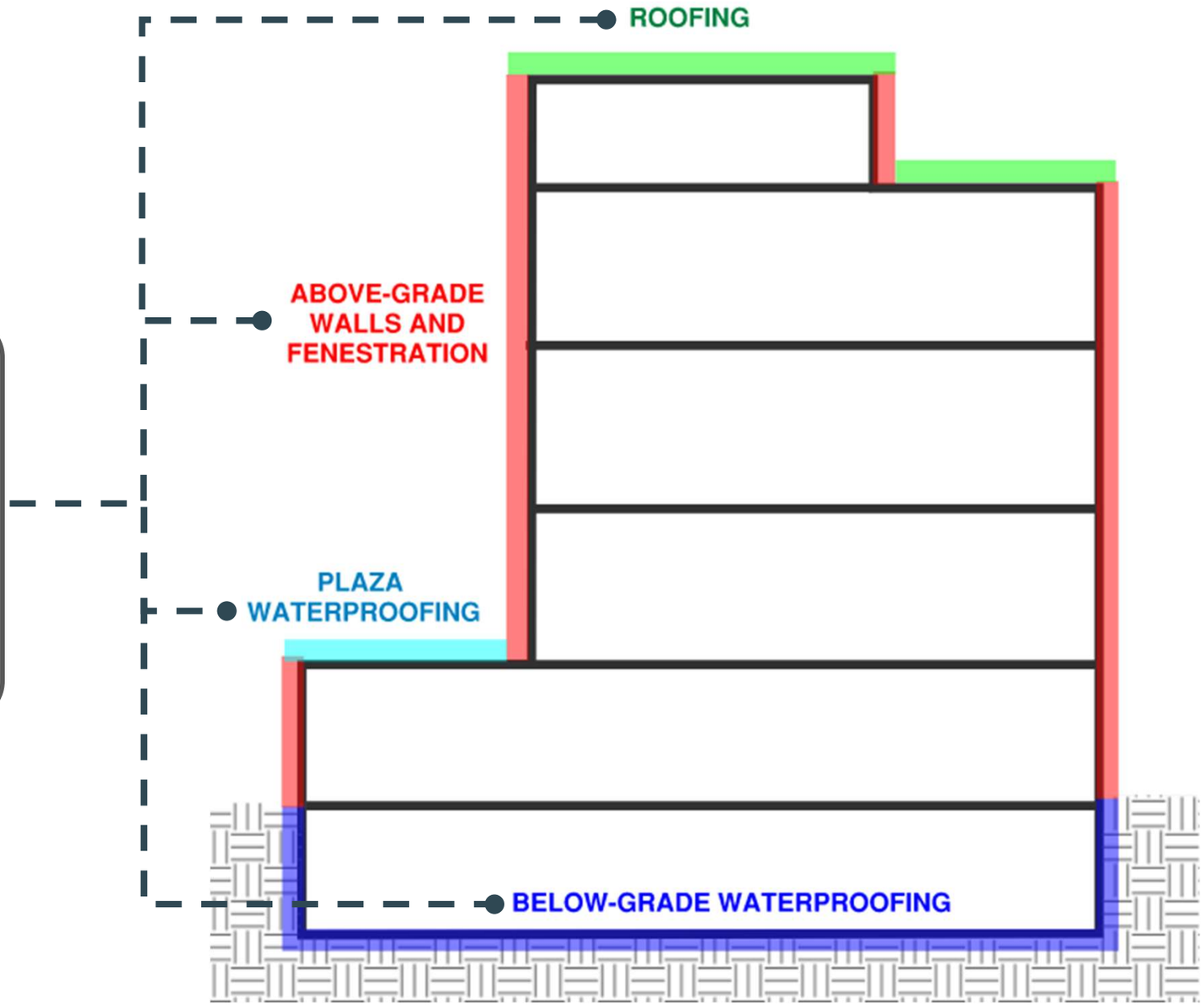
Common Construction Vulnerabilities

Proactive Management of Building Enclosure Quality

Q&A

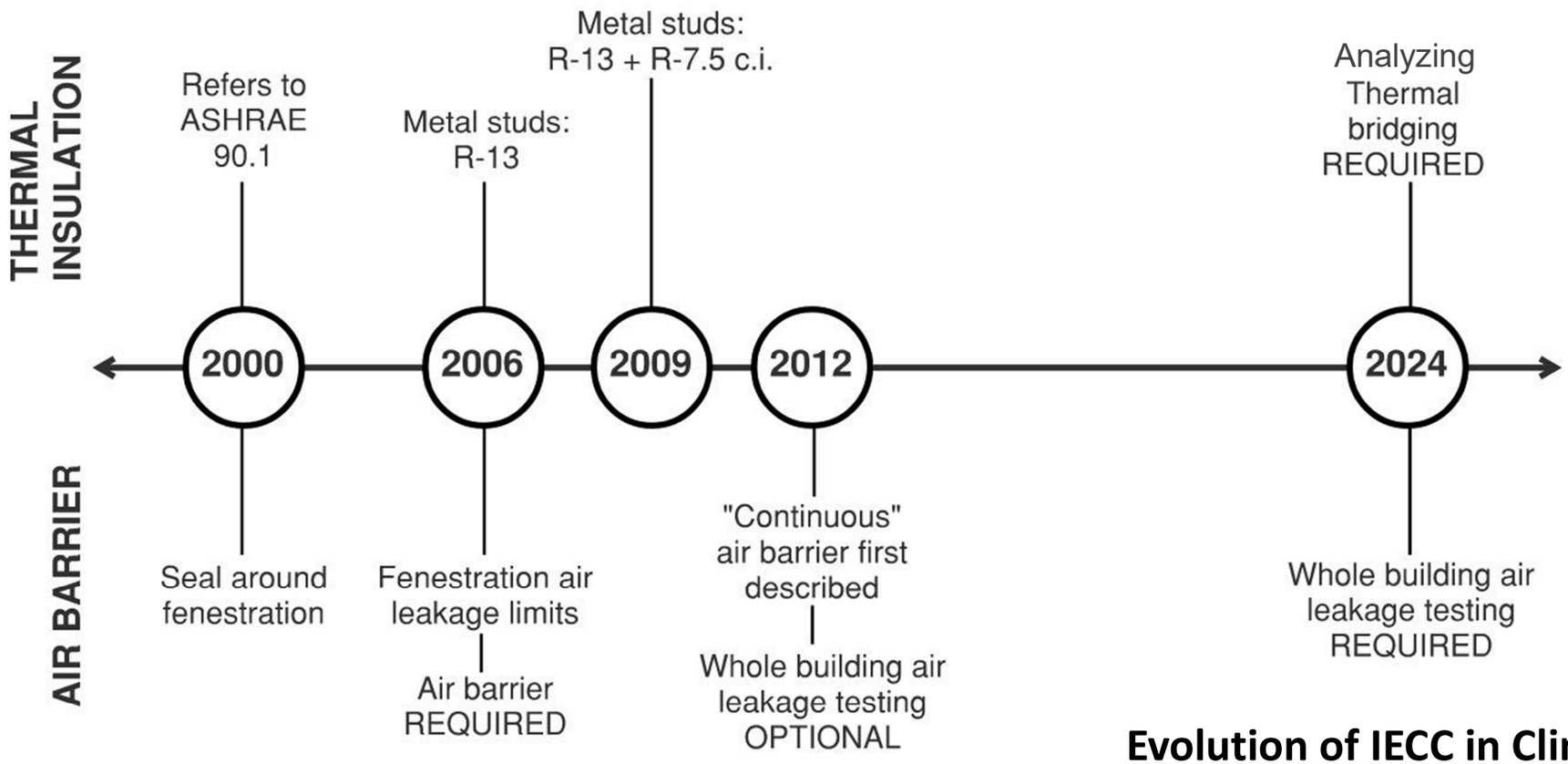
Building Enclosure Typical Components

- Water-resistive Barrier
- Thermal Barrier
- Air Barrier
- Vapor Retarder



Increasing Requirements

- Model and local building codes



Evolution of IECC in Climate Zone 4

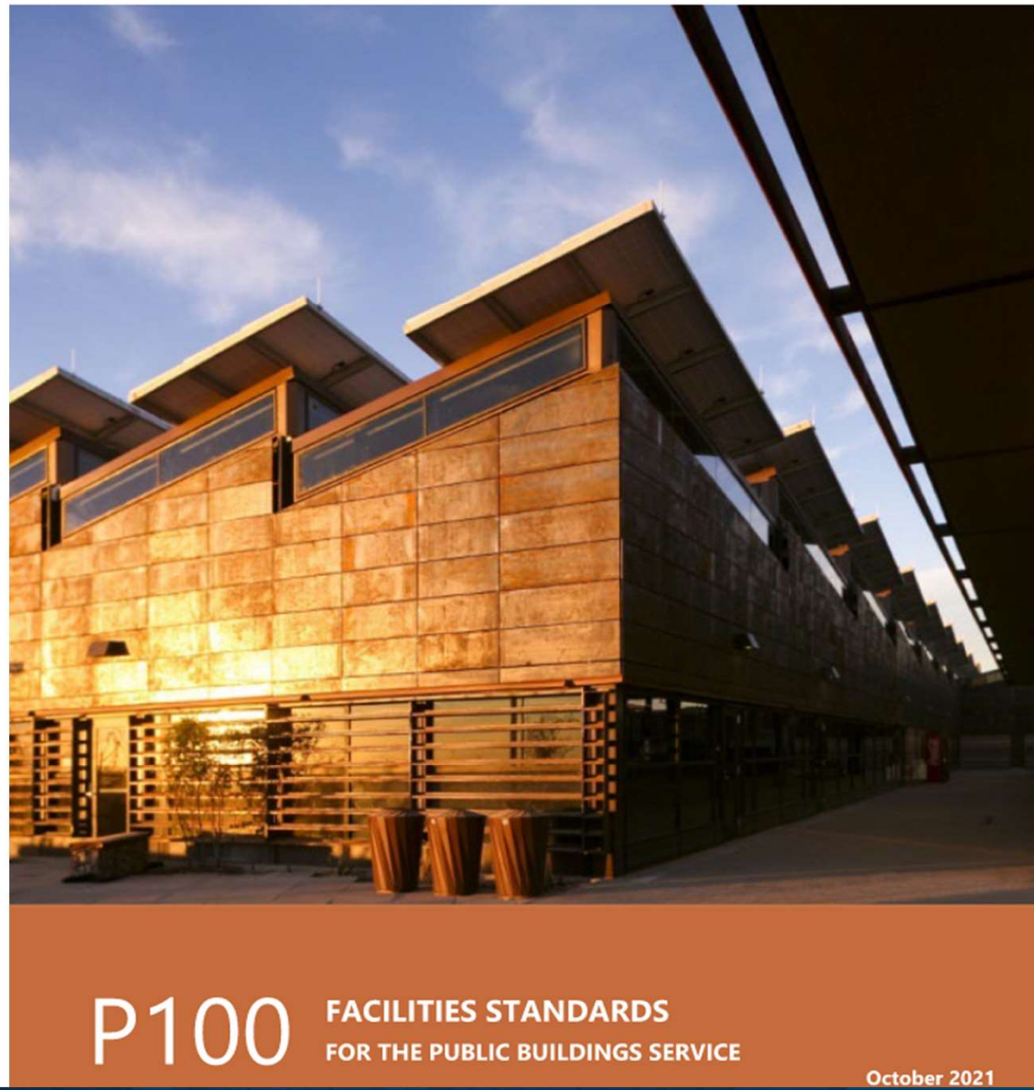
Increasing Requirements

- Model and local building codes
- Energy and performance certification programs

and more…

Increasing Requirements

- Model and local building codes
- Energy and performance certification programs
- Facility requirements and owner expectations



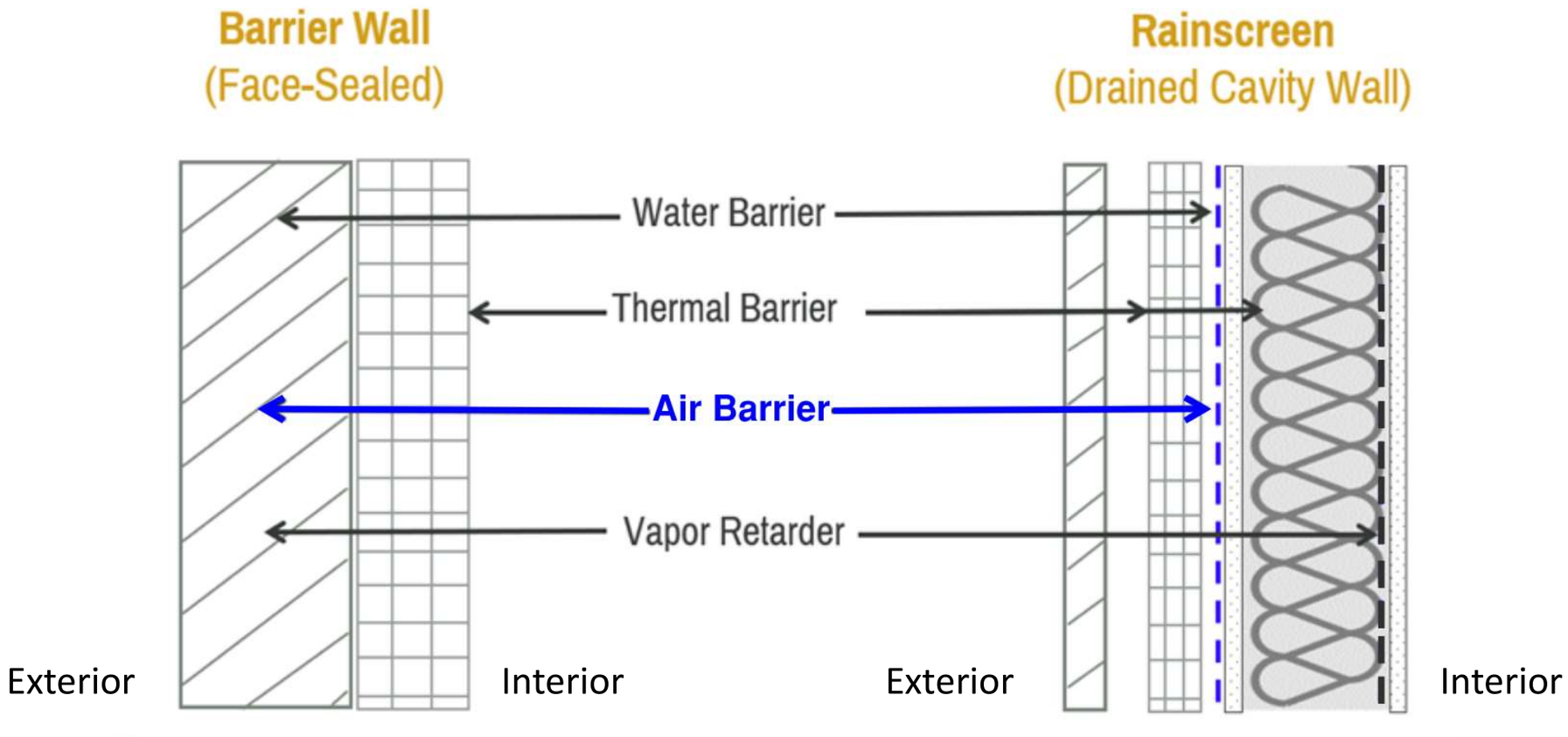




Performance Expectations

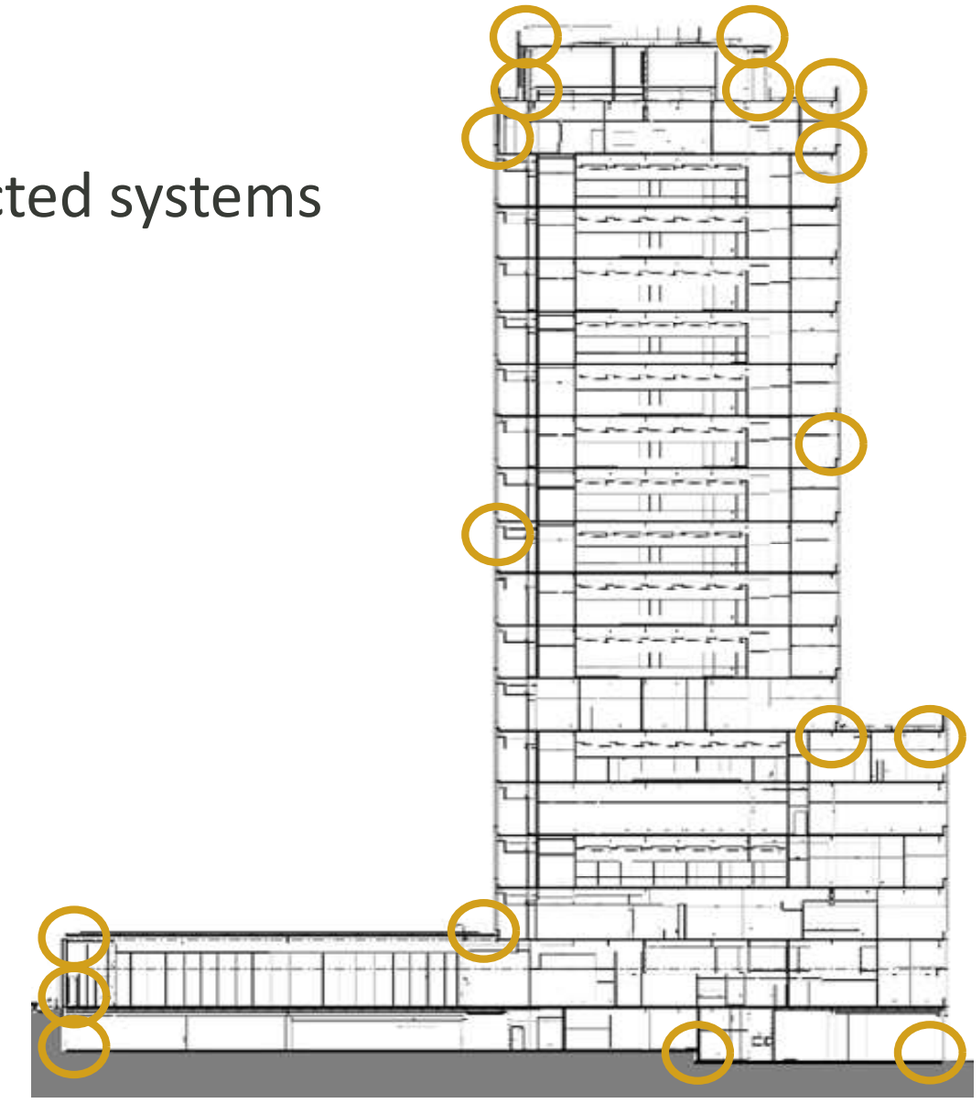
Design Complexities

- Quantity, configuration, and type of selected systems



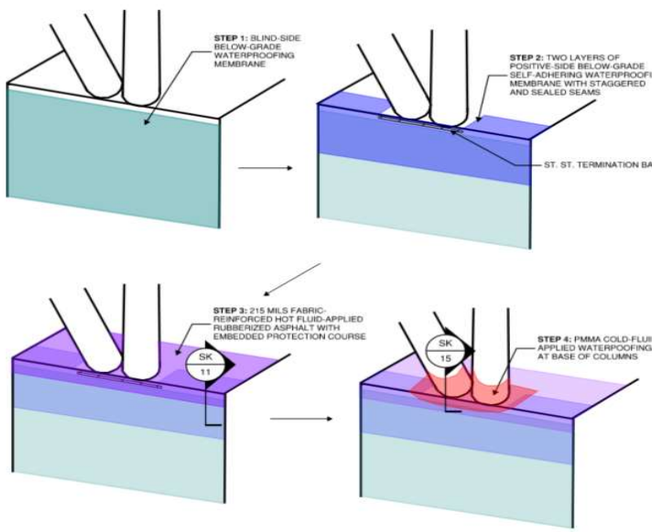
Design Complexities

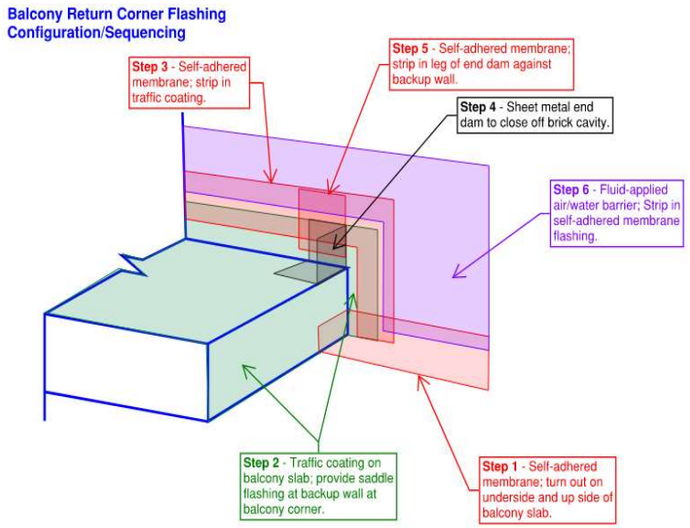
- Quantity, configuration, and type of selected systems
- Number and type of system transitions

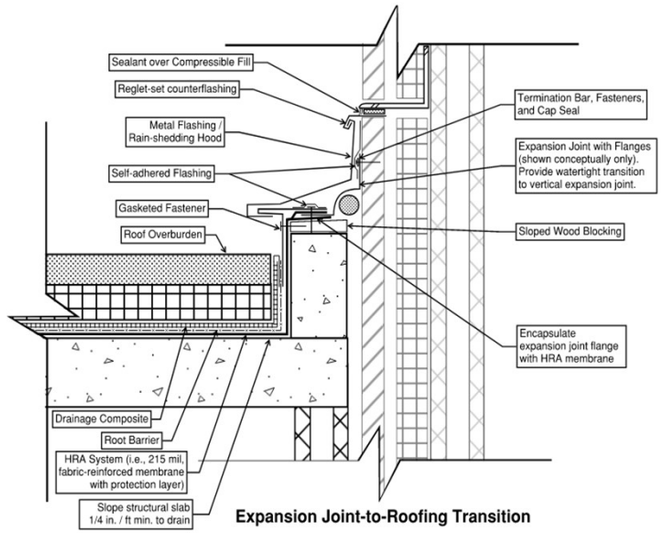


Design Complexities

- Quantity, configuration, and type of selected systems
- Number and type of system transitions
- Complicated tie-in details







Background and Significance

COMMON CONSTRUCTION VULNERABILITIES

Proactive Management of Building Enclosure Quality

Q&A

Common Construction Vulnerabilities

1. Installation and Workmanship

2. Trade Coordination and Sequencing

Installation and Workmanship

1

2

Installation and Workmanship

Common Examples:

- Manufacturer’s requirements
  - Substrate preparation
  - Membrane thickness
  - Membrane support
  - Primers

Installation and Workmanship

6. SUBSTRATE PREPARATION

6.1 Roofing systems shall be capped and sealed, or top of walls protected, in such a way as to eliminate the ability of water to saturate the wall or interior space, both before and after, air barrier system installation. Coordinate installation of ExoAir 230 with the roofing trade to ensure compatibility and continuity with the roofing system.

6.2 Continuity of the air barrier system is critical to the performance of the façade. Proper connections to the other envelope systems such as the waterproofing, flashing, roof and window/curtain wall systems shall be documented and approved by each manufacturer. Visit www.tremcosealants.com for vaious system testing performed at the Tremco Test Facility or to submit a project connection details for testing.

6.3 Surface to be coated must be dry, clean, smooth, firm, free of release agents, dust, mud, loose mortar, wires, fins, metal, projections or any other substances that might prevent placement and bonding of membrane.

6.4 ExoAir 230 may be applied to most typical building materials such as exterior sheathing boards, CMU, concrete, exterior grade plywood, OSB, metal surfaces, Nudura Insulated Concrete Forms (ICF), and insulated conrete forms.

6.5 Exterior sheathing shall be installed according to the manufacturer's installation instructions. All board edges shall be sound and achored in a way to provide minimum deflection. All board edges shall be cut cleanly and excess debris shall be removed.

6.6 CMU walls shall have all joints filled and struck flush. Mortar should be cured a minimum of 7 days. Any voids shall be patched with mortar, a non-shrinking grout or other approved patching material.

6.7 All concrete substrates shall be clean and free of all release agents. Any voids shall be patched with mortar, non-shrinking grout or other approved patching material.

6.8 Exterior grade plywood shall be securely fastened. All board joints, fasteners, knots, or other defects need to be detailed ith Tremco Dymonic 100.

Installation and Workmanship

Common Examples:

- Manufacturer’s requirements
- Seams, terminations, penetrations

Installation and Workmanship

Common Examples:

- Manufacturer’s requirements
- Seams, terminations, penetrations
- Environmental conditions
  - Inclement weather
  - Vapor drive
  - UV-exposure
  - Temperature extremes

Installation and Workmanship

Air-Bloc® 17MR Vapor Permeable Air Barrier

Limitations: **Air-Bloc® 17MR** is designed for exposure of up to 180 days, but is not designed for permanent exposure to ultraviolet light and should be covered as soon as practical after application. Do not expose the backside of the substrate to moisture or rain. Protect exposed back-up walls against wet weather conditions during and after application of membrane, including wall openings and construction activity above completed air barrier installation.

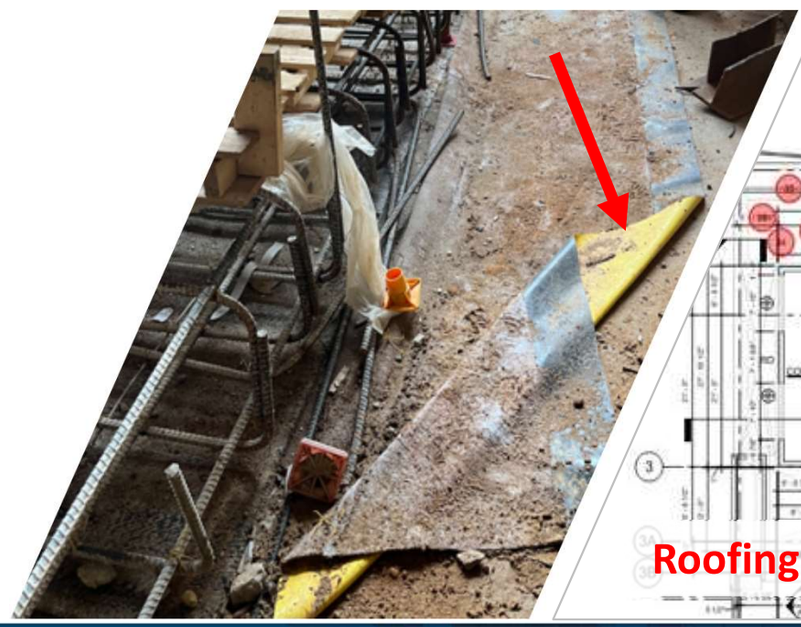
Air-Bloc® 17MR should not be applied to wet surfaces or when ambient air and substrate temperatures are below or expected to fall below 20° F (-6° C) within 48 hours. The product should not be applied if it is raining, or if the possibility of rain is likely within 16 hours.

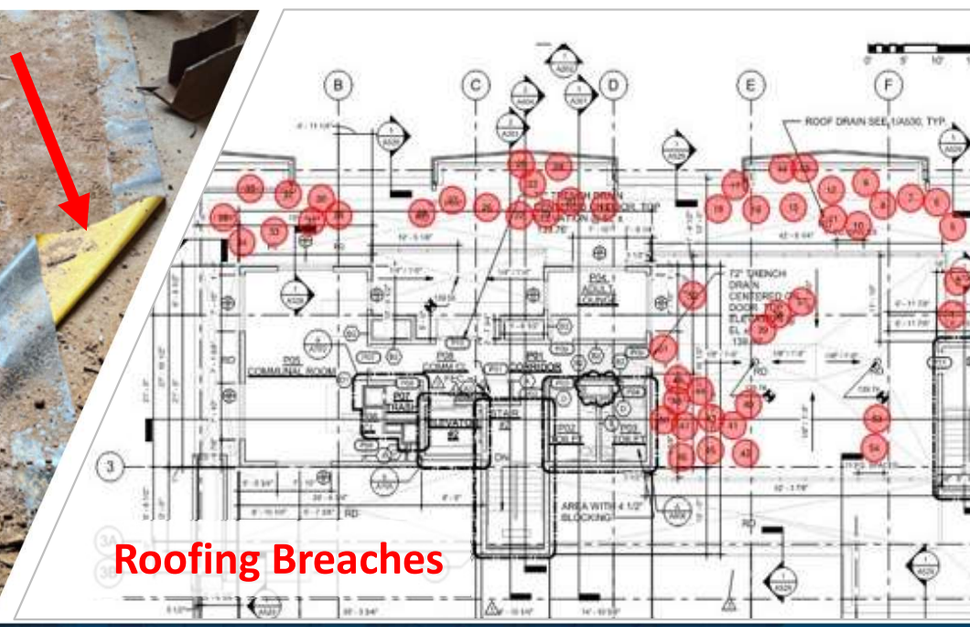
In hot weather or direct sun applications over porous substrates, such as concrete, rapid surface drying can form blisters. A thin 'prime coat' application to substrate, which is allowed to dry, often prevents blister formation in subsequent application. Alternatively, a two coat application vs. single heavy coat – with back rolling of base coat – also aids in prevention of blistering in hot weather. **Air-Bloc® 17MR** is non-resistant to oils, grease or solvents.

Installation and Workmanship

Common Examples:

- Manufacturer’s requirements
- Seams, terminations, penetrations
- Environmental conditions
- Protection of installed work





Roofing Breaches

Installation and Workmanship

Common Examples:

- Manufacturer's requirements
- Seams, terminations, penetrations
- Environmental conditions
- Protection of installed work

Common Impacts:

- Direct paths for air and water leakage
- Material deterioration/damage
- Rework
- Warrantability

Trade Coordination and Sequencing

1

2

Trade Coordination and Sequencing

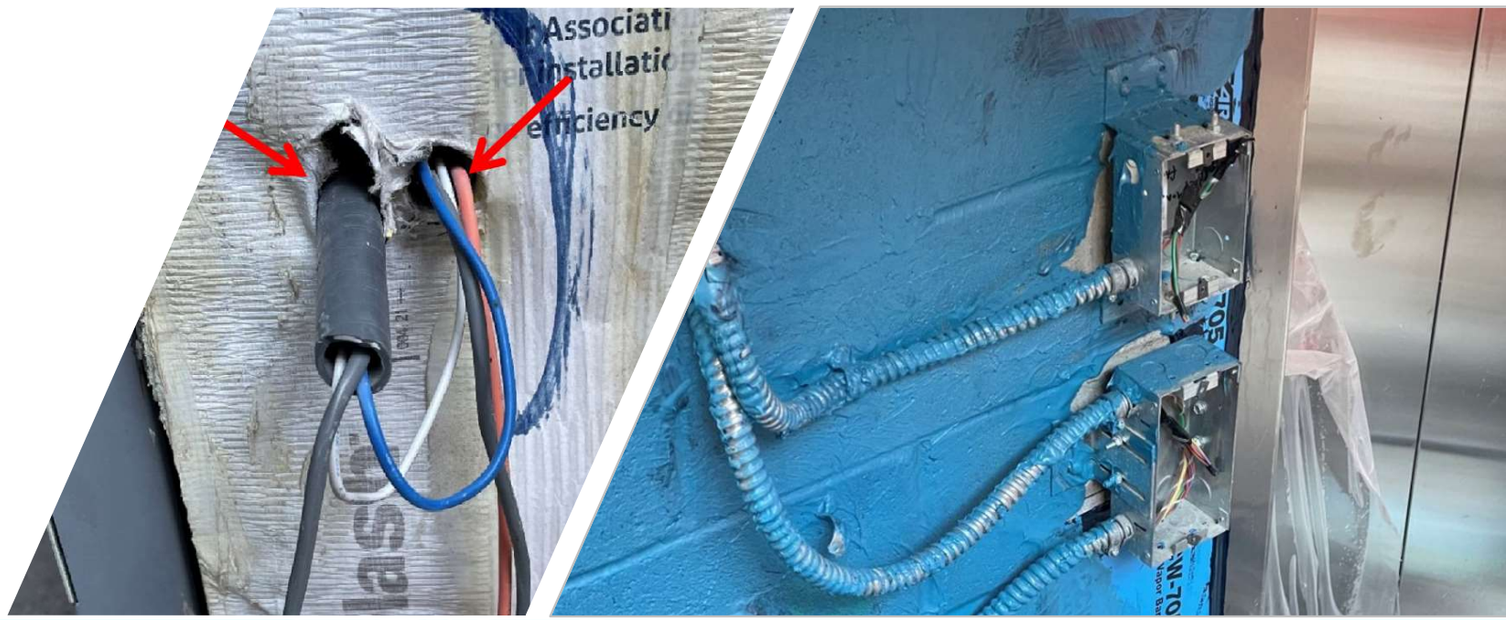
Common Examples:

- System transitions
  - Roof-to-rising wall
  - Balcony-to-rising wall
  - Parapets
  - Windows/joint sealants/cladding

Trade Coordination and Sequencing

Common Examples:

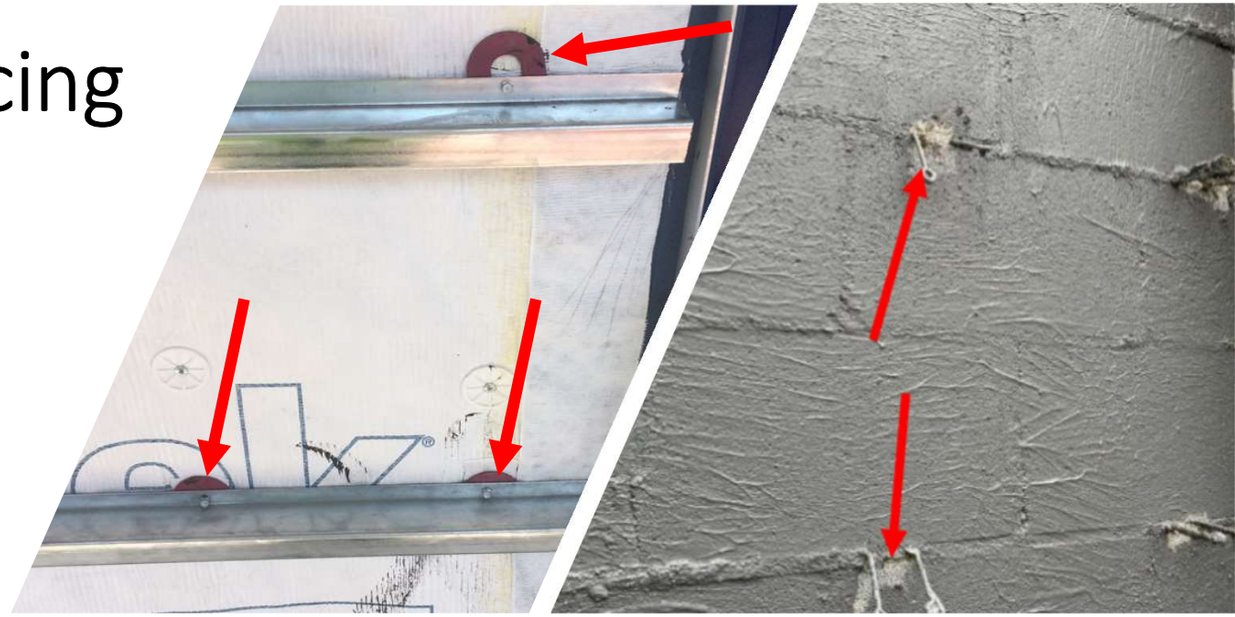
- System transitions
- MEP penetrations



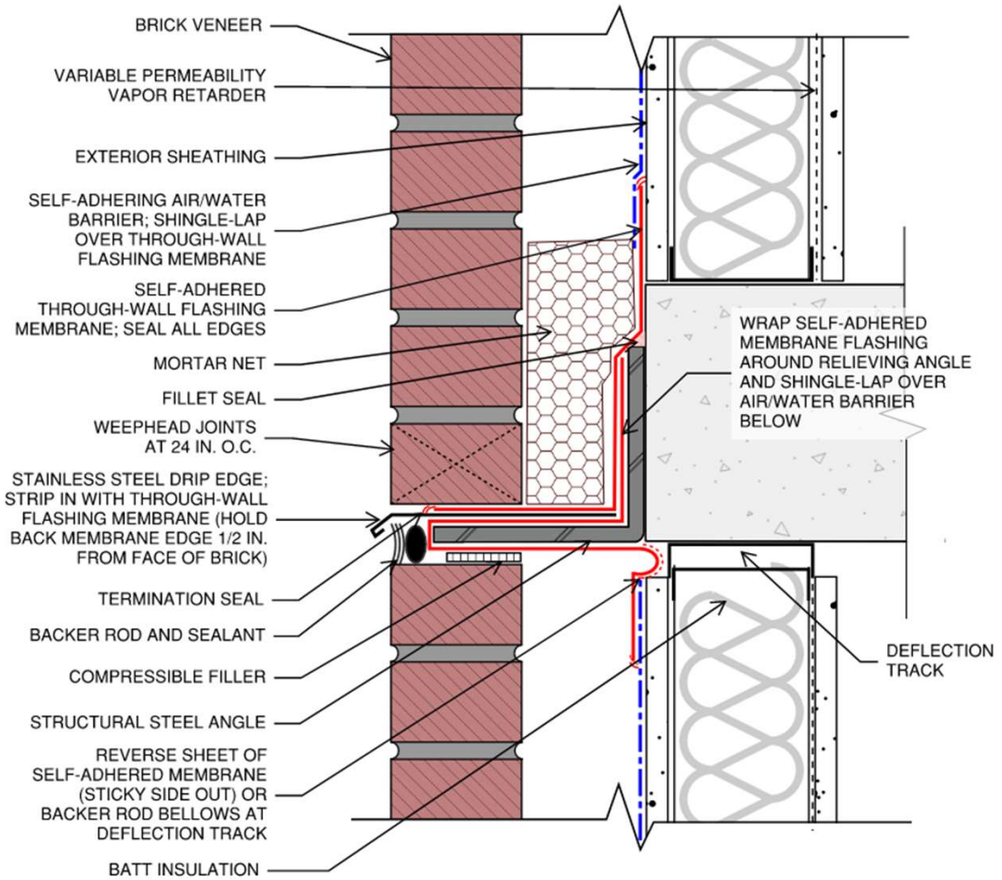
Trade Coordination and Sequencing

Common Examples:

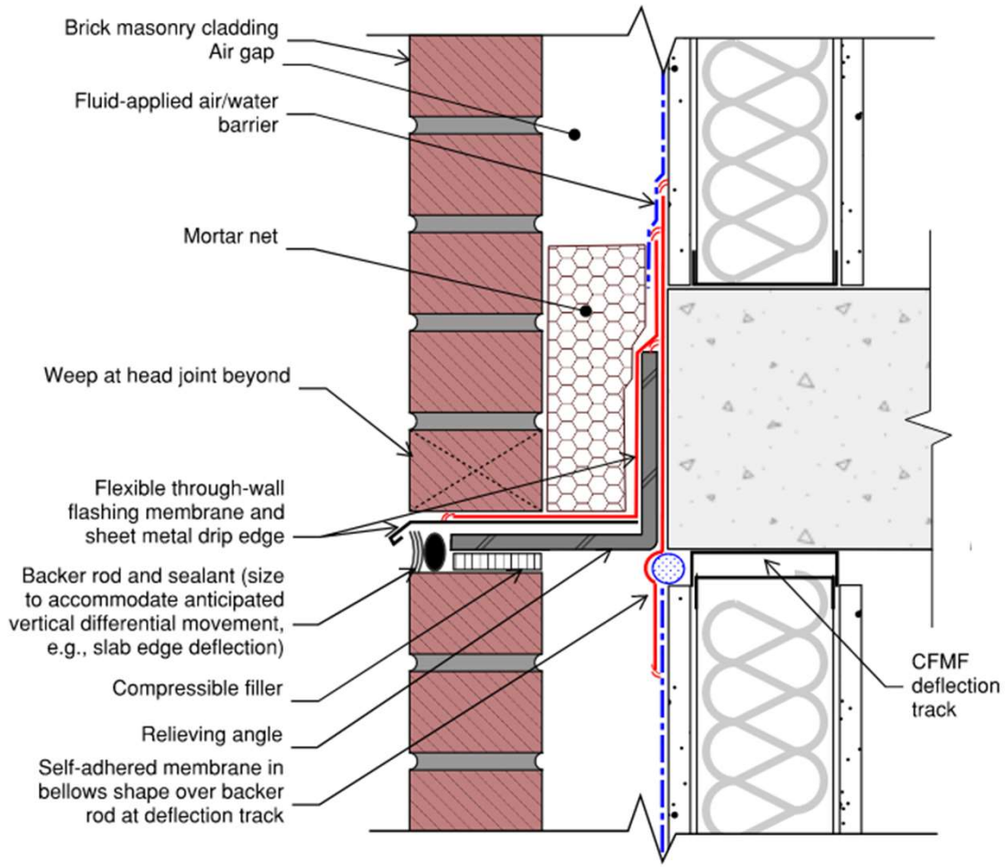
- System transitions
- MEP penetrations
- Cladding attachments/supports



Trade Coordination and Sequencing



Note: Relieving angle anchor bolts and brick ties not shown for clarity.



Note: Relieving angle anchor bolts and brick ties not shown for clarity.

Trade Coordination and Sequencing

Common Examples:

- System transitions
- MEP penetrations
- Cladding attachments
- Dry-in/interior finishes

Trade Coordination and Sequencing

Common Examples:

- System transitions
- MEP penetrations
- Cladding attachments
- Dry-in/interior finishes
- Field verification/dimensions

Trade Coordination and Sequencing

Common Examples:

- System transitions
- MEP penetrations
- Cladding attachments
- Dry-in/interior finishes
- Field verification/dimensions
- Material compatibility

Trade Coordination and Sequencing

PECORA CORPORATION
Architectural Weatherproofing Products
U.S.A. • since 1862

Technical Bulletin #166
Pecora Sealant Adhesion to Air and Vapor Membranes

Table Key: **R** = Recommended for use
R / Primer = Recommended for use with designated primer
NR = Not recommended for use
ND = No data

Product Type	*Sealant*					
	864NST	**890NST**	**890FTS**	**895NST**	**AVB**	**Dynatrol I-XL HYBRID**
Liquid Applied Air and Vapor Membranes						
BASF Acrostop R Vapor Permeable Membrane	R	R	R	R	R	ND
BASF MasterSeal AWB 660 (Formerly Enershield HP)	R	R	R	R	R	ND
BASF MasterSeal AWB 665	ND	R	R	ND	ND	ND
BASF Senershield-R	R	R	R	ND	R	ND
Carlisle Barriseal (Roller & Spray Grade)	NR	NR	NR	NR	R	ND
Carlisle Barritech NP	R	R	R	ND	R	ND
Carlisle Barritech VP	R	R	R	R	R	ND
Carlisle Barrithane VP (STPE)	R	R	NR	NR	NR	R
Dow DefendAir 200 Air & Weather Barrier	R	R	ND	ND	R	ND
Dryvit Backstop NT (Smooth and Textured)	R	R	R	R	R	ND
DuPont Tyvek Fluid Applied Weather Barrier	NR	NR	NR	NR	R	ND
GE Elemax 2600 Silicone Fluid Applied Air Barrier	R	R	R	R	R	R

[1] *Application to polyethylene side only (where applicable). Contact with asphaltic side of peel and stick may result in discoloration and loss of adhesion. Since Pecora architectural sealants are applied to varied substrates under diverse environmental conditions and construction situations, it is recommended that substrate testing be conducted prior to application. If this is not possible prior to sealant application a field adhesion test may be conducted as outlined in Pecora's Technical Bulletin #55.*

Trade Coordination and Sequencing

1. Henry Air/Water Barrier 2. DuPont Self-Adhered Flashing/Sheet Good 3. Zip Self-Adhered Flashing

Trade Coordination and Sequencing

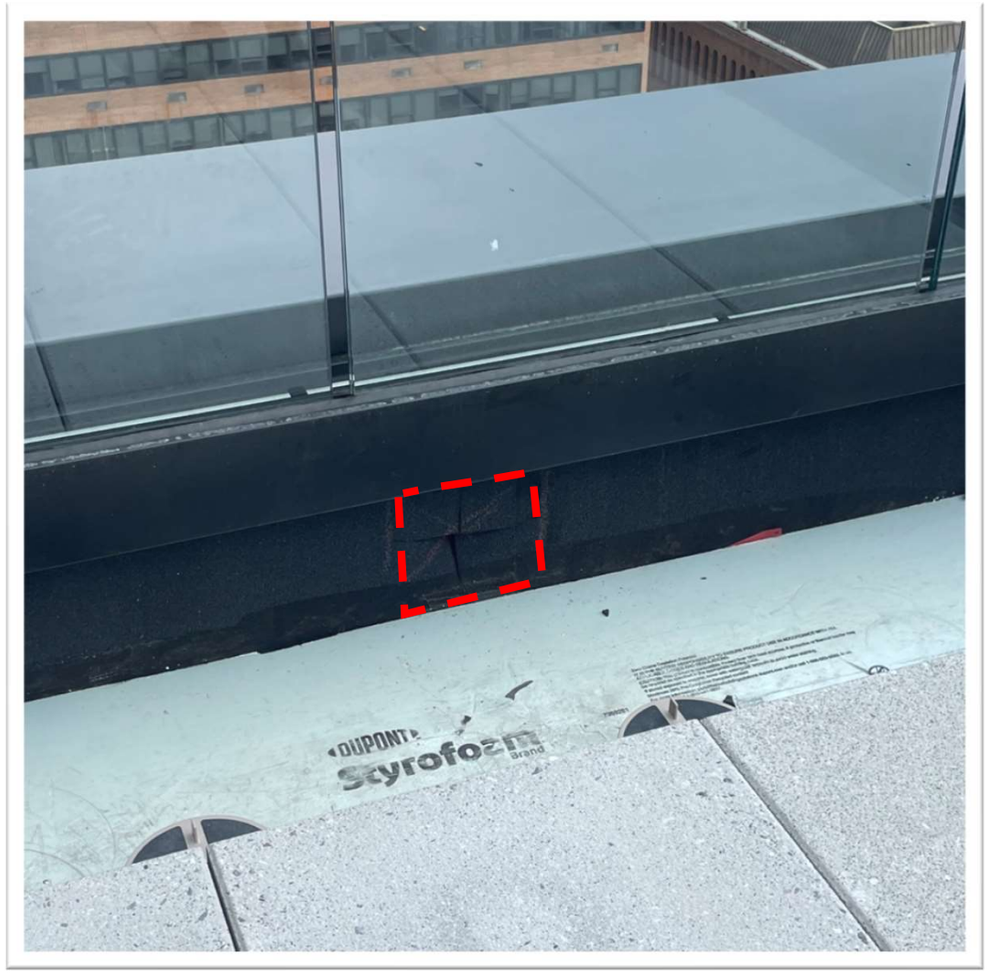
Common Examples:

- System transitions
- MEP penetrations
- Cladding attachments
- Dry-in/Interior finishes
- Field verification/dimensions
- Material compatibility

Common Impacts:

- Compromised performance
- Material deterioration/damage
- Rework
- Schedule delays

Quick Story…



Background and Significance

Common Construction Vulnerabilities

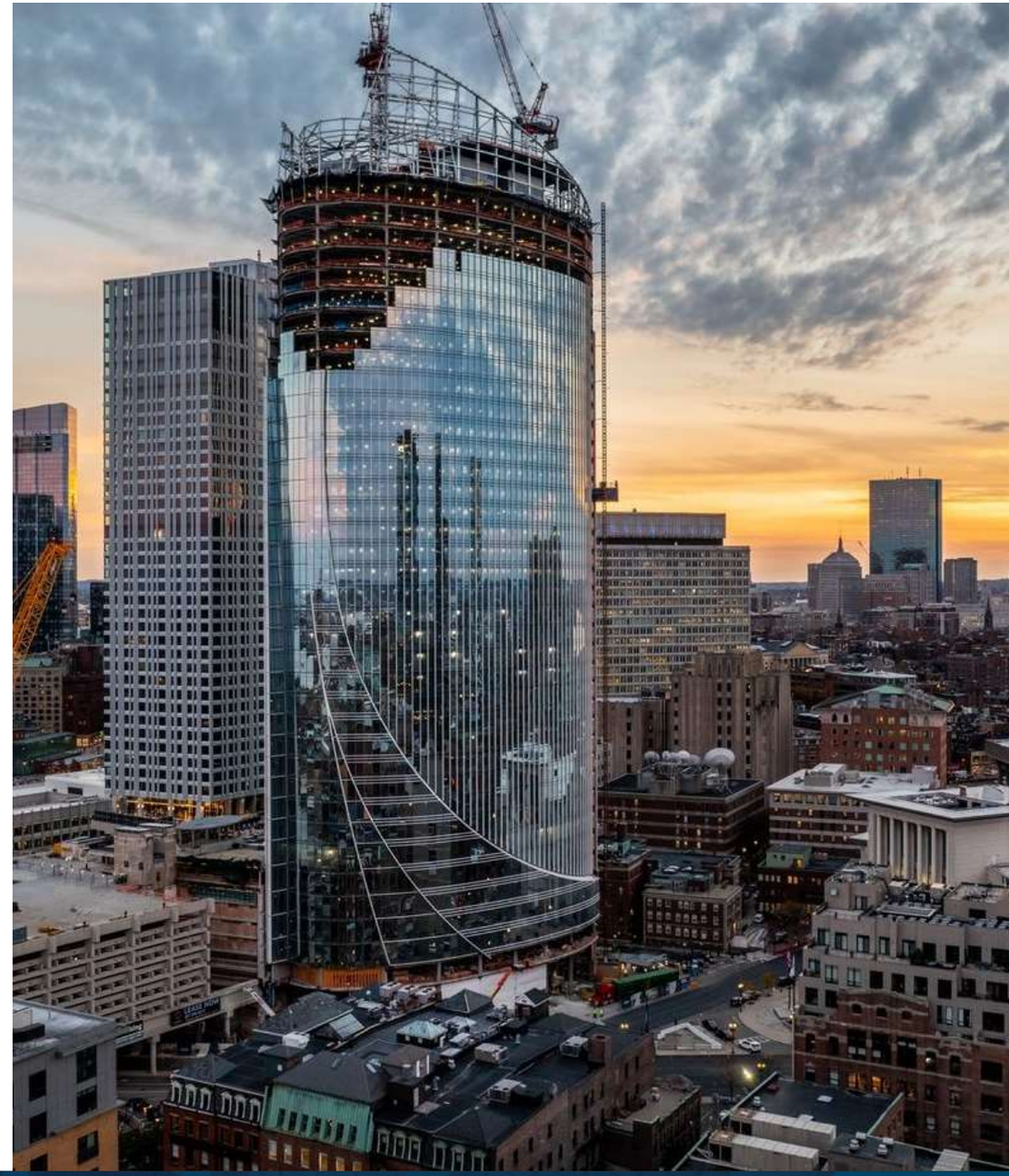
PROACTIVE MANAGEMENT OF BUILDING ENCLOSURE QUALITY

Q&A

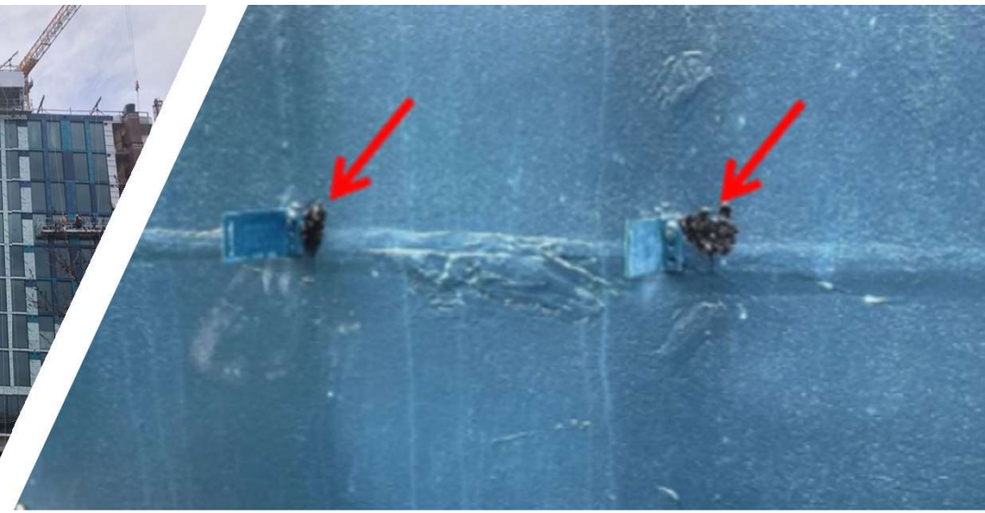
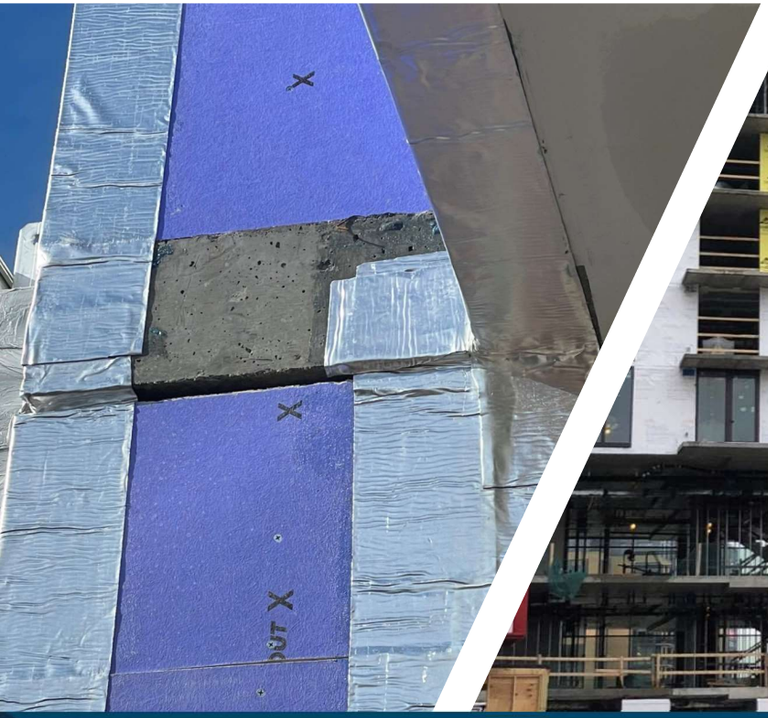
Proactive Management of Building Enclosure Quality

1. Construction Administration

2. Construction Monitoring and Testing






Construction Administration

1

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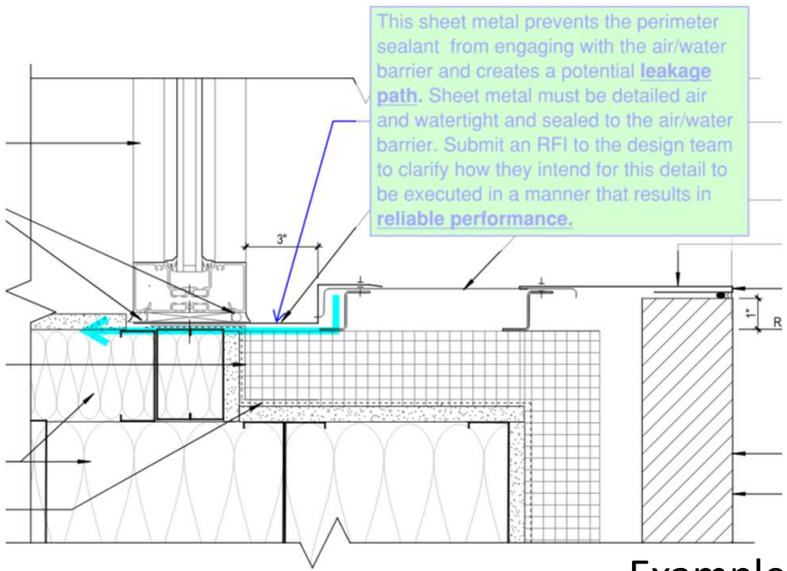
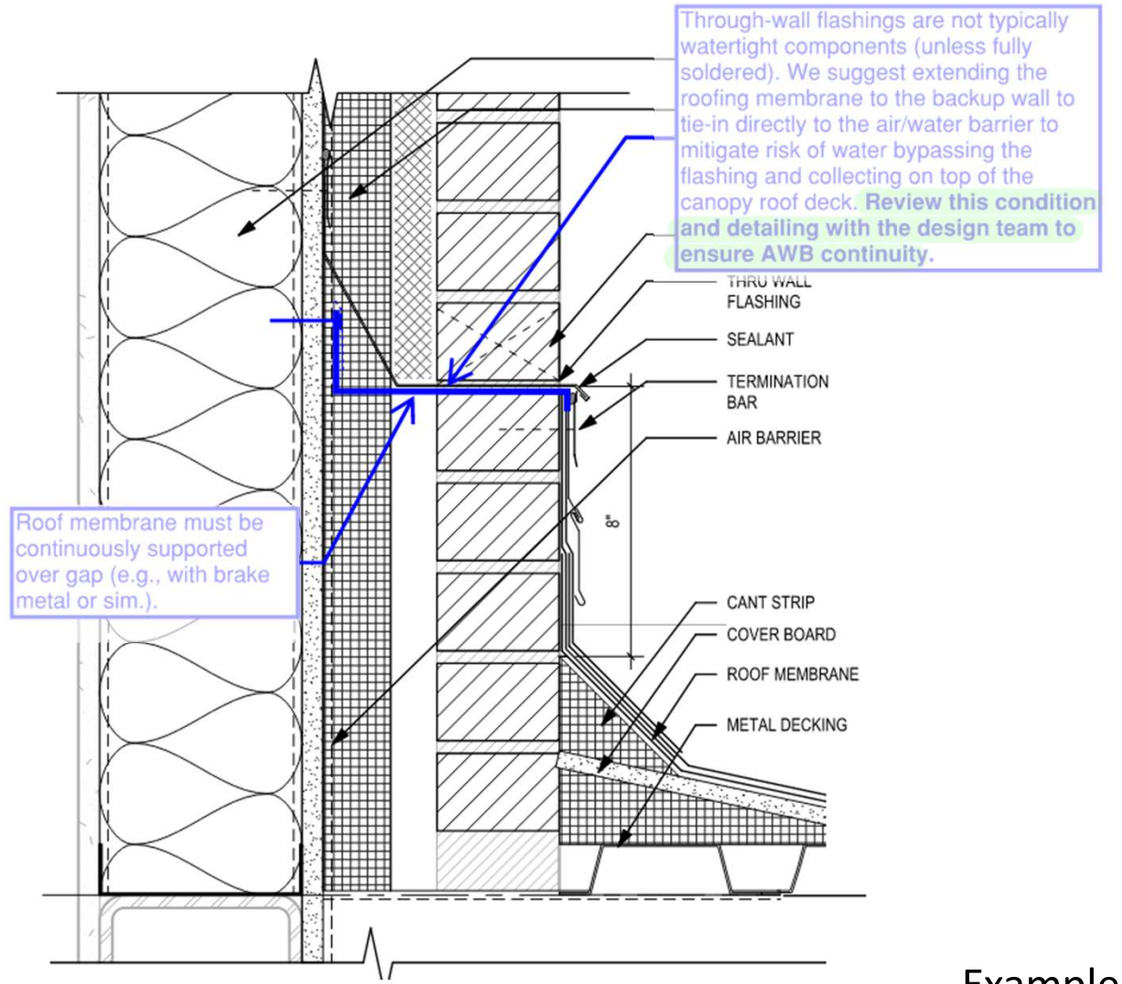
Construction Administration

Key Opportunities:

- Design review



Example



Example

Construction Administration

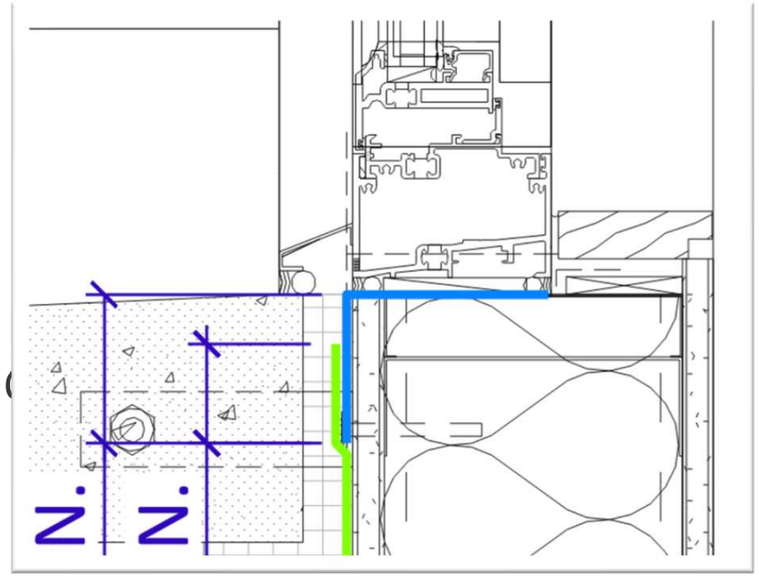
Key Opportunities:

- Design review
- Product selection
  - Appropriateness for project/site exposures
  - Compatibility with adjacent systems/materials
  - Warrantability

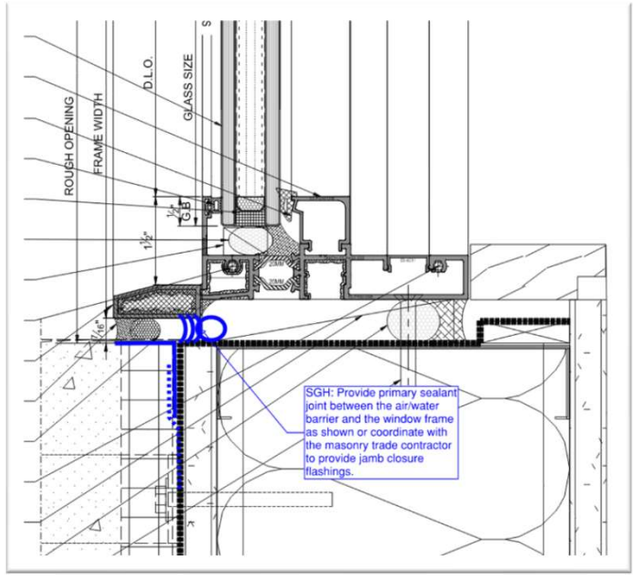
Construction Administration

Key Opportunities:

- Design review
- Product selection
- Trade coordination
  - Project-specific submittals and coordinated shop drawings



Air/Water Barrier Shop Drawings

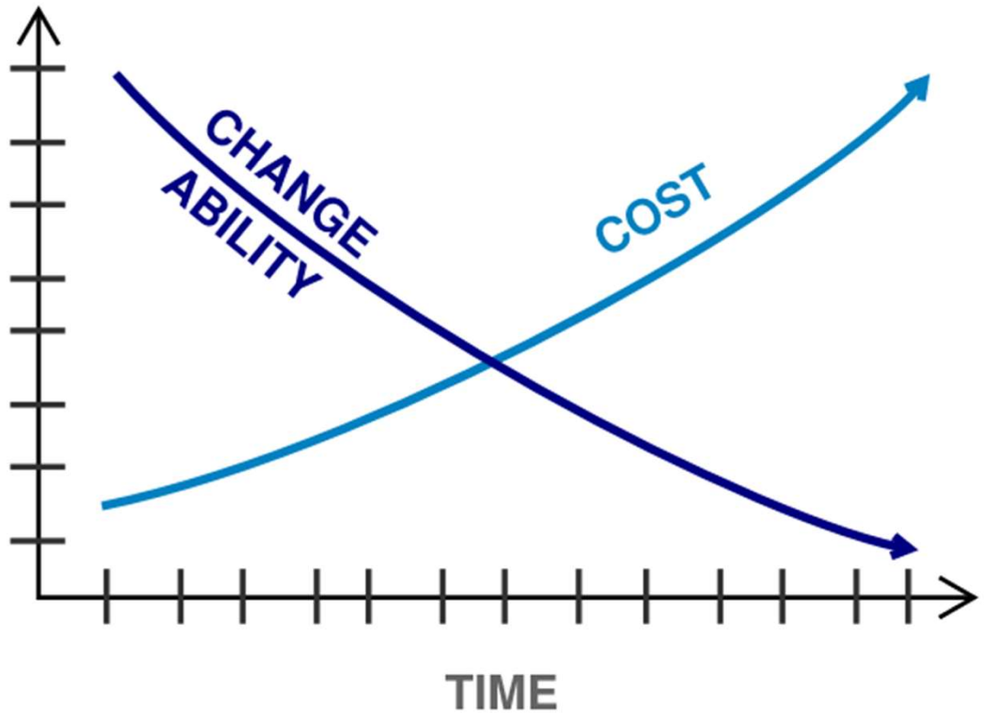


Window Shop Drawings

Construction Administration

Key Opportunities:

- Design review
- Product selection
- Trade coordination
  - Project-specific submittals and coordinated shop drawings



Construction Administration

Key Opportunities:

- Design review
- Product selection
- Trade coordination
  - Project-specific submittals ar coordinated shop drawings
  - Trade-specific preconstruction meetings

C. Pre-Installation Conference: Conduct conference at Project site.

1. Include installers of other construction connecting to air barrier, including roofing, sheathing, masonry, sealants, flashing and sheet metal trim, storefront systems, glazed curtain walls, aluminum windows, and door frames.
2. Review air barrier requirements including surface preparation, substrate condition and pretreatment, minimum substrate curing period, forecasted weather conditions, special details and sheet flashings, installation procedures, sequence of installation, testing and inspecting procedures, and protection and repairs.

Construction Administration

Key Opportunities:

- Design review
- Product selection
- Trade coordination
  - Project-specific submittals and coordinated shop drawings
  - Trade-specific preconstruction meetings
  - Building enclosure preconstruction meeting

B. Attendees: The BECxP, Owner, DOR, Contractor, and a qualified representative (foreman, site superintendent, or project manager) from each building enclosure subcontractor shall attend the Building Enclosure Commissioning Preconstruction Meeting. Suppliers and manufacturer technical representatives related to the building enclosure work are also required to attend.

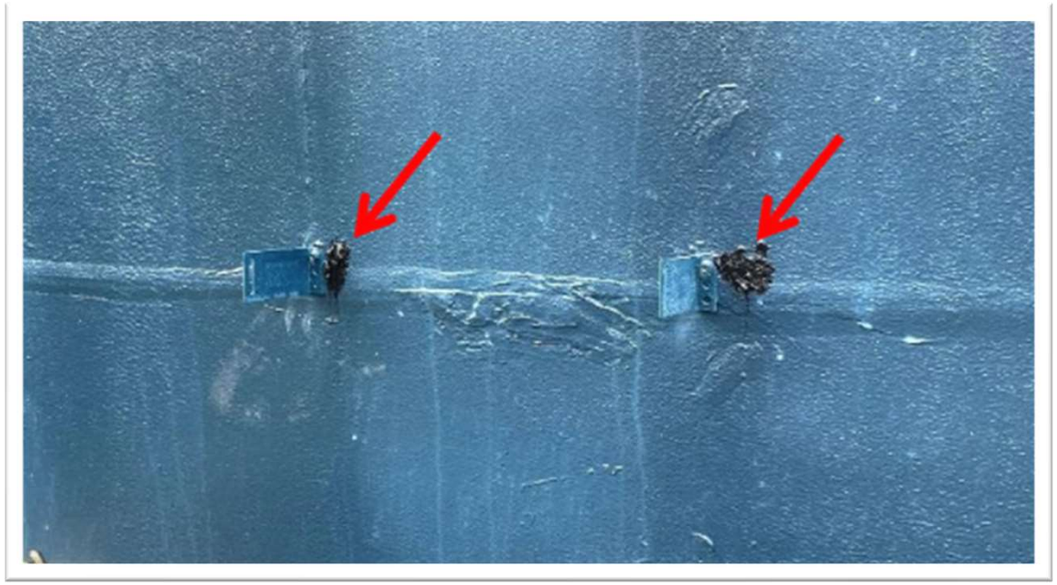
C. Agenda: Discuss items of significance that could affect progress, including, but not limited to the following:

1. Designation of Key Personnel and Their Duties.
2. Commissioning Process, Purpose, Goals, and Related Specifications.
3. Tentative Construction Schedule.
4. Phasing.
5. Critical Work Sequencing.
6. Mockup Construction and Testing.
7. Procedures for Testing and Inspecting.
8. Submittal Procedures.
9. Preparation of Record/As-Built Documents.
10. Closeout Manual.
11. Post-Occupancy Visit.

Construction Administration

Key Opportunities:

- Design review
- Product selection
- Trade coordination
  - Project-specific submittals and coordinated shop drawings
  - Trade-specific preconstruction meetings
  - Building enclosure coordination meeting
  - Proactive field coordination



Construction Administration

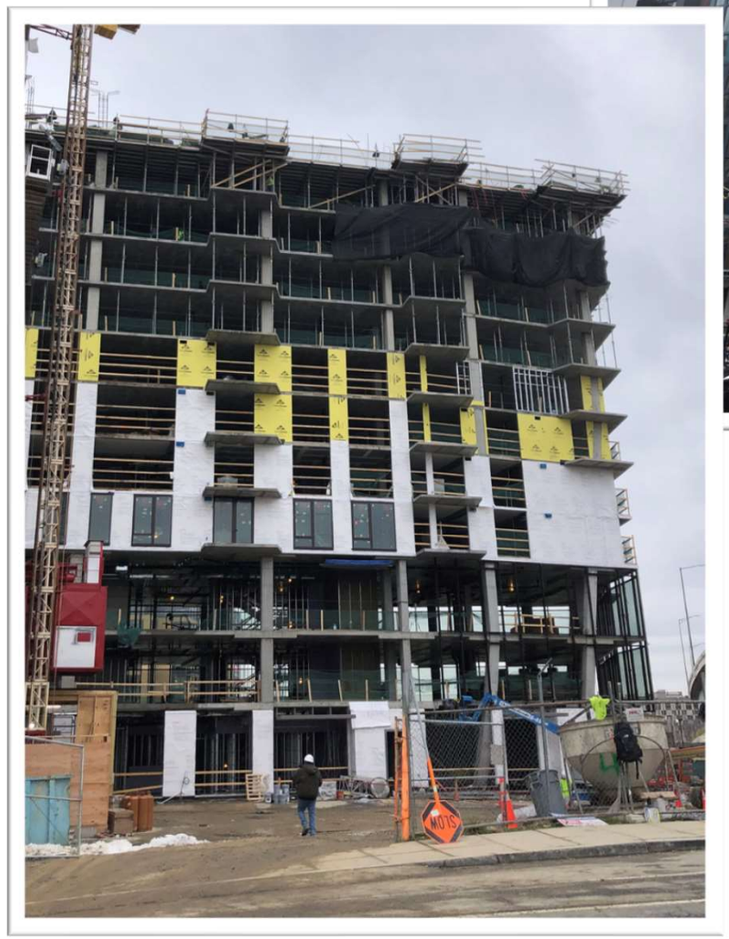
Key Opportunities:

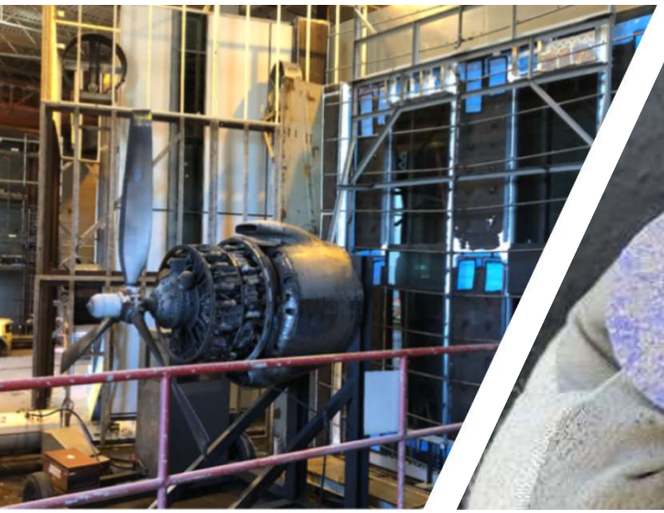
- Design review
- Product selection
- Trade coordination
- Sequencing
  - Trade-specific sequencing and pre-detailing

Construction Administration

Key Opportunities:

- Design review
- Product selection
- Trade coordination
- Sequencing
  - Trade-specific sequencing and pre-detailing
  - Building-wide sequencing








Construction Monitoring and Testing

1

2

Construction Monitoring and Testing

Key Opportunities:

- Mockups
  - Coordinated facade mockups
    - Laboratory

Construction Monitoring and Testing

Key Opportunities:

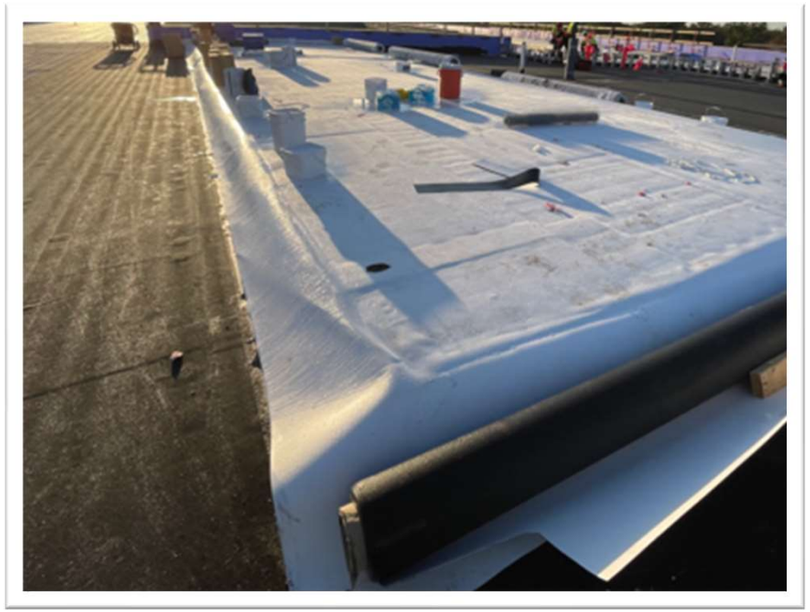
- Mockups
  - Coordinated facade mockups
    - Laboratory
    - On-site stand-alone

Construction Monitoring and Testing

Key Opportunities:

- Mockups
  - Coordinated facade mockups
    - Laboratory
    - Stand-alone
  - First installation mockups

Exterior Insulation Attachment Mockup

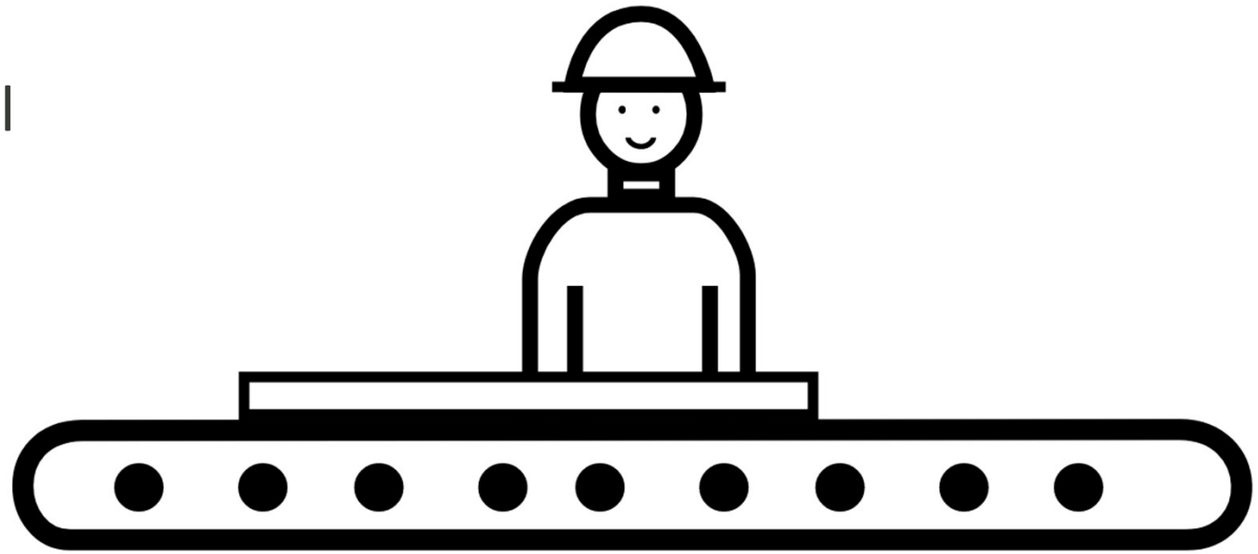


Roofing Mockup

Construction Monitoring and Testing

Key Opportunities:

- Mockups
- Quality assurance/quality control
  - Factory visits



Construction Monitoring and Testing

Key Opportunities:

- Mockups
- Quality assurance/quality control
  - Factory visits
  - Contractor QA/QC protocol
  - Installer QA/QC protocol

Construction Monitoring and Testing

Key Opportunities:

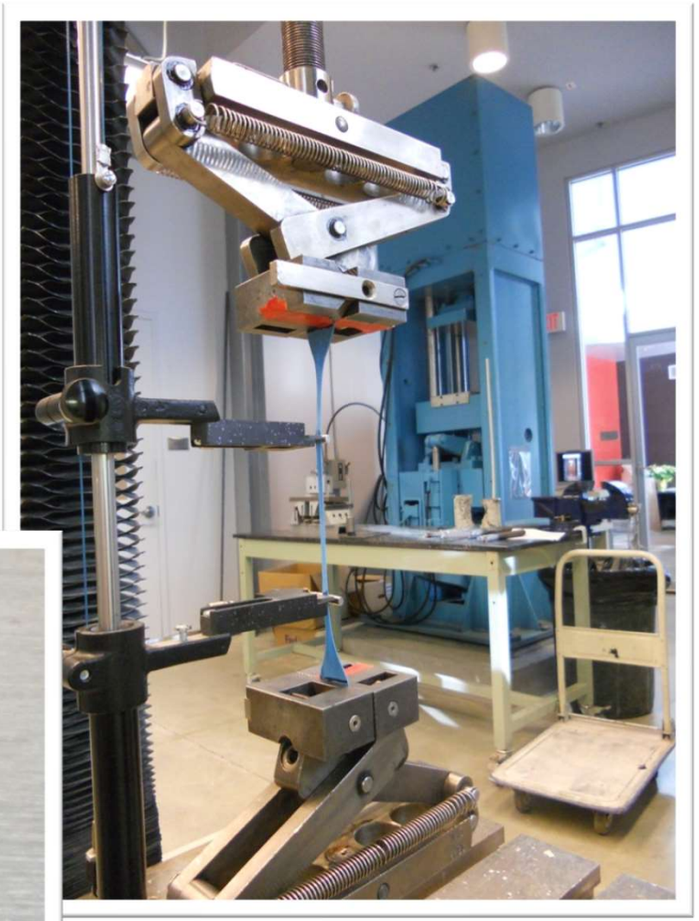
- Mockups
- Quality assurance/quality control
  - Contractor QA/QC protocol
  - Installer QA/QC protocol
  - Manufacturer, third-party inspections

Item No.	Photo	Observations and Discussion
3.6	 **Photo 10 –** Revse lap between traffic coating and air/water barrier (arrow) at the base of a balcony rising wall.	At a ninth-floor balcony, the traffic coating detail strip at the base of the rising wall extends up outboard of the air/water barrier resulting in a reverse lap (Photo 10). The design drawings show the traffic coating extending up the vertical face of the backup wall a minimum of 4 in. and shingle-lapped by the air/water barrier.
Recommended Action: Shingle lap the traffic coating with the air/water barrier at balcony rising walls (including within door and window rough openings) in accordance with in the design drawings.		

Construction Monitoring and Testing

Key Opportunities:

- Mockups
- Quality assurance/quality control
- Verification testing
  - Preconstruction testing
    - Material testing
    - Adhesion/compatibility testing



Construction Monitoring and Testing

Key Opportunities:

- Mockups
- Quality assurance/quality control
- Verification testing
  - Preconstruction testing
  - Field performance testing

Construction Monitoring and Testing

“The truth is that teamwork is at the heart of great achievement.”

John C. Maxwell

Take-Aways

- Increasing building enclosure performance demands require scrutiny during design and construction.
- Careful oversight and management of construction vulnerabilities, including those related to installation/workmanship and trade coordination/sequencing, is required.
- A holistic understanding of the building enclosure systems and their interdependencies is critical.
- Proactive management of building enclosure quality is a team effort.

Questions?

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