Air Barrier Installation and Quality Control Fundamentals

Melissa I. Payne, BECxP, CxA+BE, CDT
Midwest Enclosure Consulting, LLC

Air Barrier Installation and Quality Control Fundamentals

Join us for an informative presentation that emphasizes the importance of proper air barrier application in enhancing building performance. Properly installed air barriers are critical in preventing air leakage, which can lead to energy inefficiencies, moisture issues, and compromised indoor air quality.

We will delve into best practices for air barrier application, highlighting the techniques that ensure continuity and effectiveness. Attendees will learn about common challenges faced during installation and the vital role of quality control in maintaining the integrity of the air barrier system.

Through real-world project photo's, we'll illustrate key application requirements for a variety of air barrier materials and exactly what to look for when performing quality control and site-testing

Melissa I. Payne
BECxP, CxA+BE, CDT

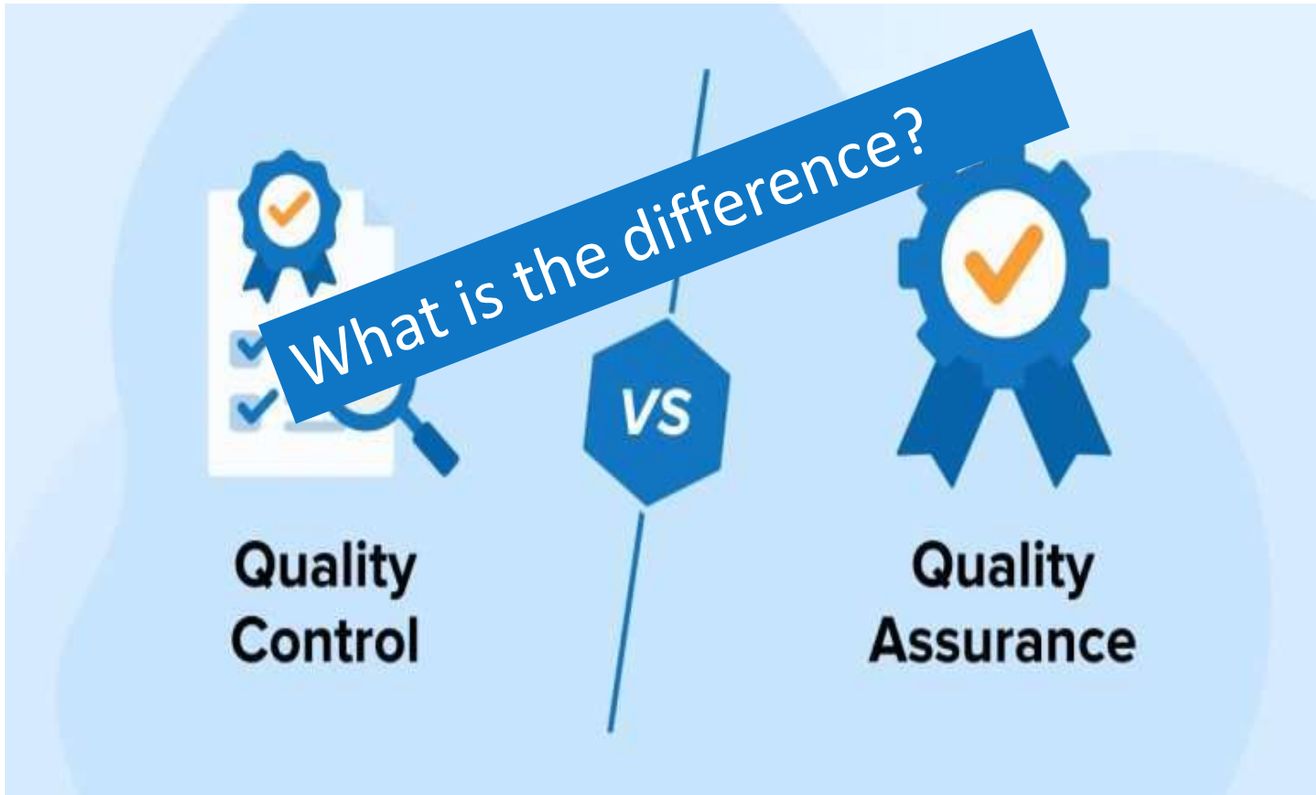
Ms. Payne possesses a strong foundation in industry standards related to building envelope commissioning processes, commissioning authority, building science, construction observation, performance testing, project management, and general construction of building envelope systems for schools, higher education, government, healthcare, hospitality, and industrial projects. Her owner representative, third-party consulting experience, forensic work, commissioning provider background, and manufacturer internal consultant involvement gives her an all-enveloping perspective of the design and construction industry.

abaa EDUCATION

Learning Objectives

1. Identify Key Installation Techniques
2. Recognize Common Installation Challenges
3. Implement Quality Control Measures
4. Evaluate Real-World Applications

Quality Management vs Quality Control



What is Quality Assurance?

The planned and systematic activities implemented in a quality system so that quality requirements for a product or service will be fulfilled

What is Quality Control?

Inspection, Audit and Site Observation

Quality Management vs Quality Control

Quality Assurance

- Total Approach - Proactive
- Control Errors
- Prevention – Early Involvement
- Systematic – Process Oriented

Quality Control

- Inspection – Actively Monitoring
- Product Oriented
- Acceptance of Sampling

ICC INTERNATIONAL CODE COUNCIL®

Codes and Standards

- “Codes” are documents that are adopted by the legal authority in your jurisdiction and:
  - Establish minimum performance requirements to achieve life safety and property protection
  - Are written in mandatory language indication ***what*** must be done.

- “Standards” are document reference in the codes and indicate ***how*** to achieve what must be done

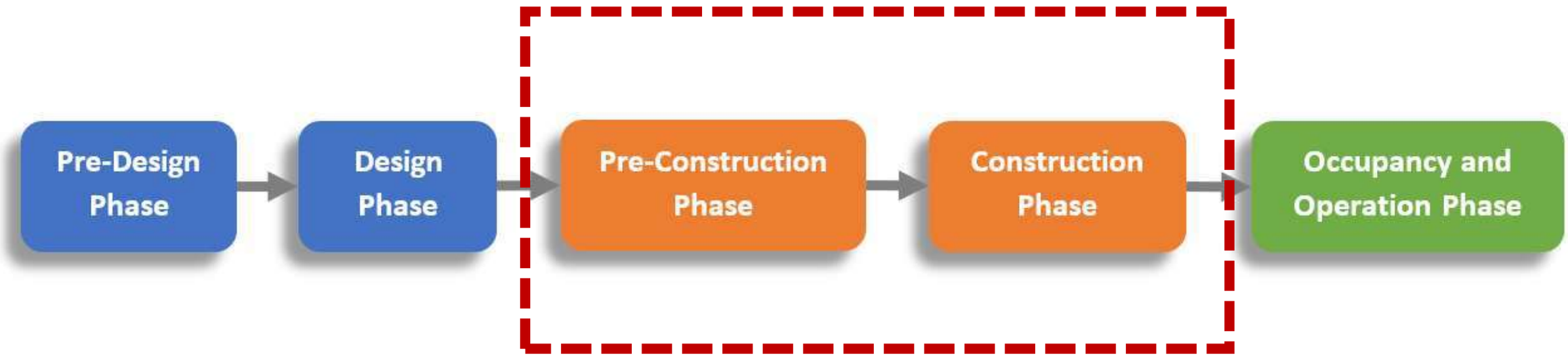
Source: Jason Toves, International Code Council

2012 IECC Definition

Building Commissioning (C202)

"A process that verifies and documents that the selected building systems have been designed, installed, and function according to the owner's project requirements and construction documents, and to minimum code requirements."

Commissioning Inspections – Code and ASTM Driven



ABAA Quality Assurance Program

What should be Audited?

ABAA Program requirements

- Physical testing
- Proper correction of deficiencies
- Safety
- Documentation

What should be Inspected?

Limited to above grade air barrier material items included in the inspection scope.

- Materials used
- Qualification of Installers
- Environmental Conditions
- Substrate conditions and preparation
- Visual Inspection and Installed material application

Typical Conditions to Consider…

General Environmental Conditions

Substrate Preparation applicable to all materials that rely on adhesion

Self-Adhered Membranes

Fluid Applied Membranes

Sprayed Polyurethane Foam

Insulating and non-Insulating board stock

Commercial Building Wraps

General Environmental Conditions…

Ambient Temperatures

Substrate Temperature

Relative Humidity

General Environmental Conditions

AMBIENT TEMPERATURES

- Most materials will have parameters for storage and installation
- Conditions will be different as you move around the building (sunny side, shaded side)
- Can be significant difference between ambient and substrate
- Important to note manufacturers limitations

General Environmental Conditions

AMBIENT TEMPERATURES

- Substrate vs Ambient can have SIGNIFICANT differences in temperature
- Need to assess if installation can continue

General Environmental Conditions

RELATIVE HUMIDITY

- Relative Humidity typically will impact how quickly a fluid applied or primer may dry
- Require to understand what materials are a moisture cure vs. a chemical cure

General Environmental Conditions

RELATIVE HUMIDITY

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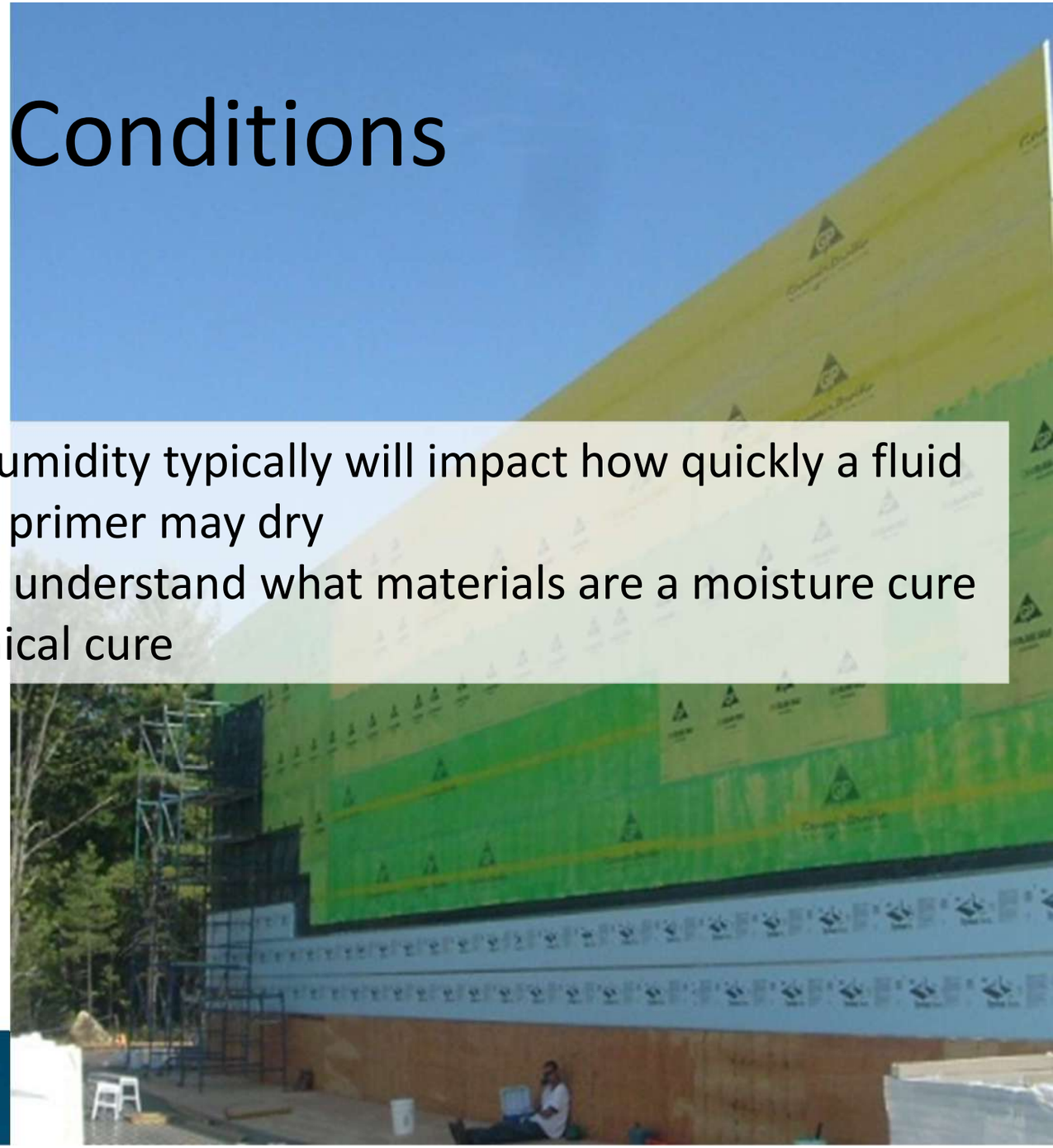
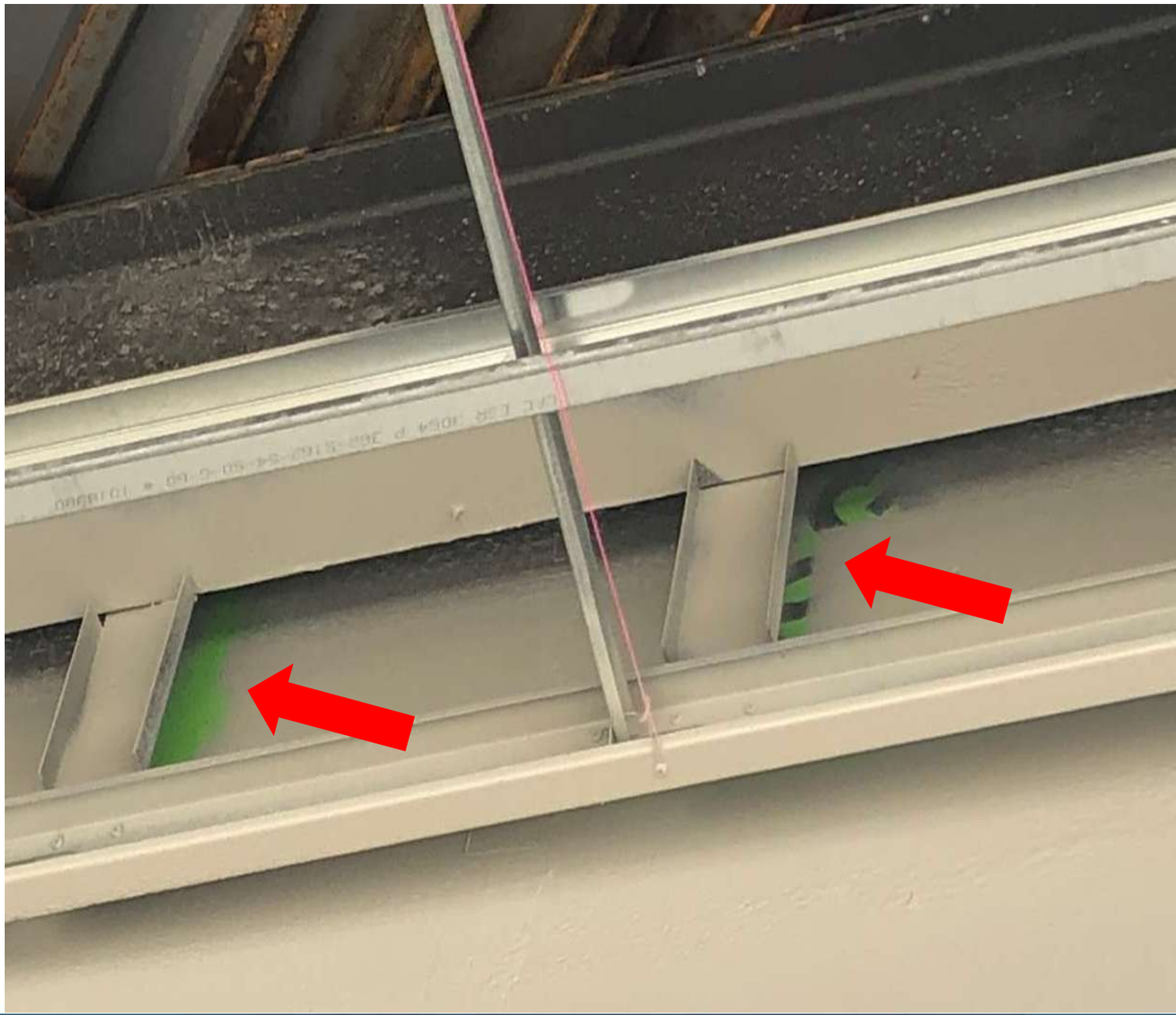
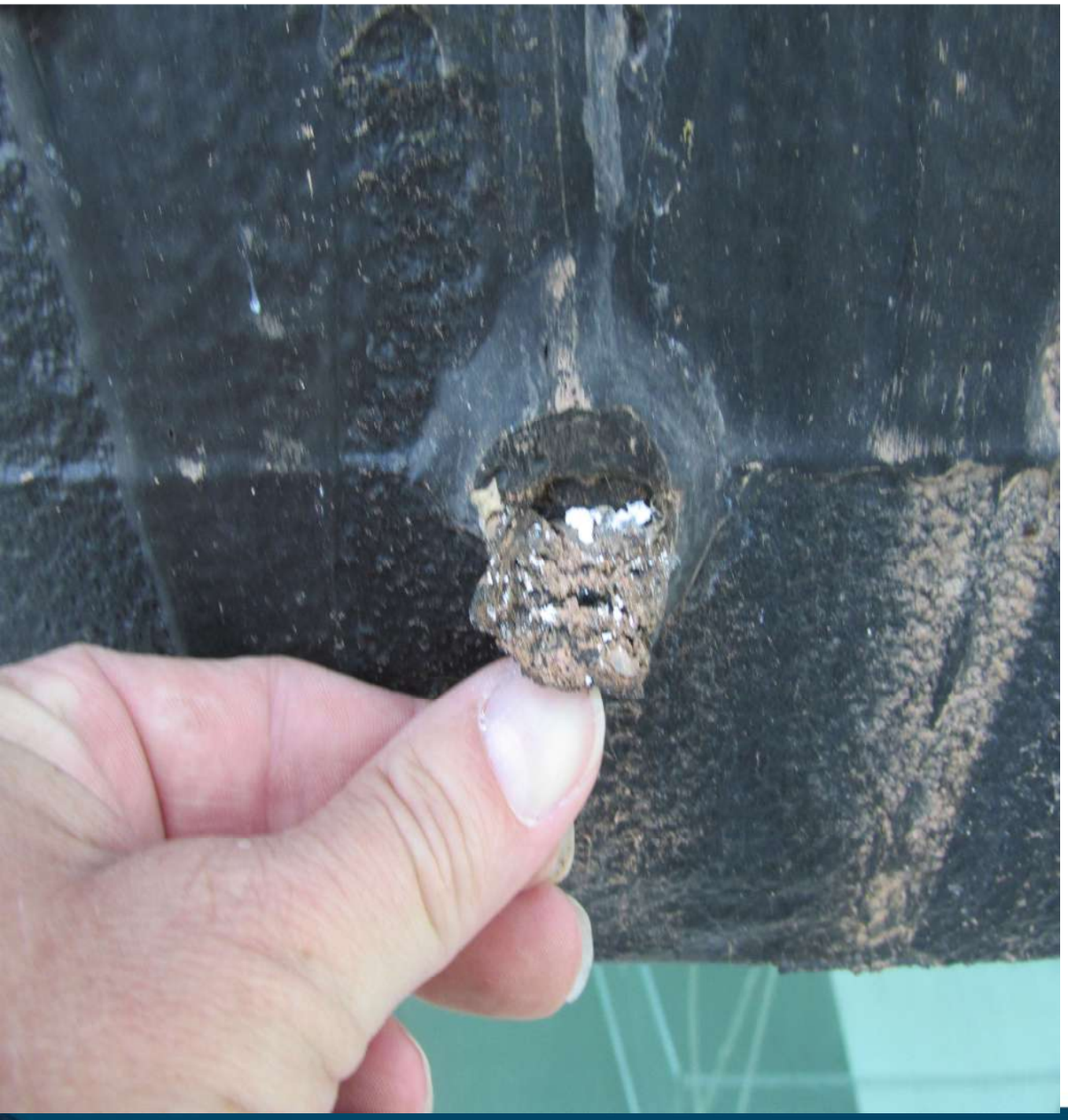
- Require to understand what materials are a moisture cure vs. a chemical cure



Construction Sequencing

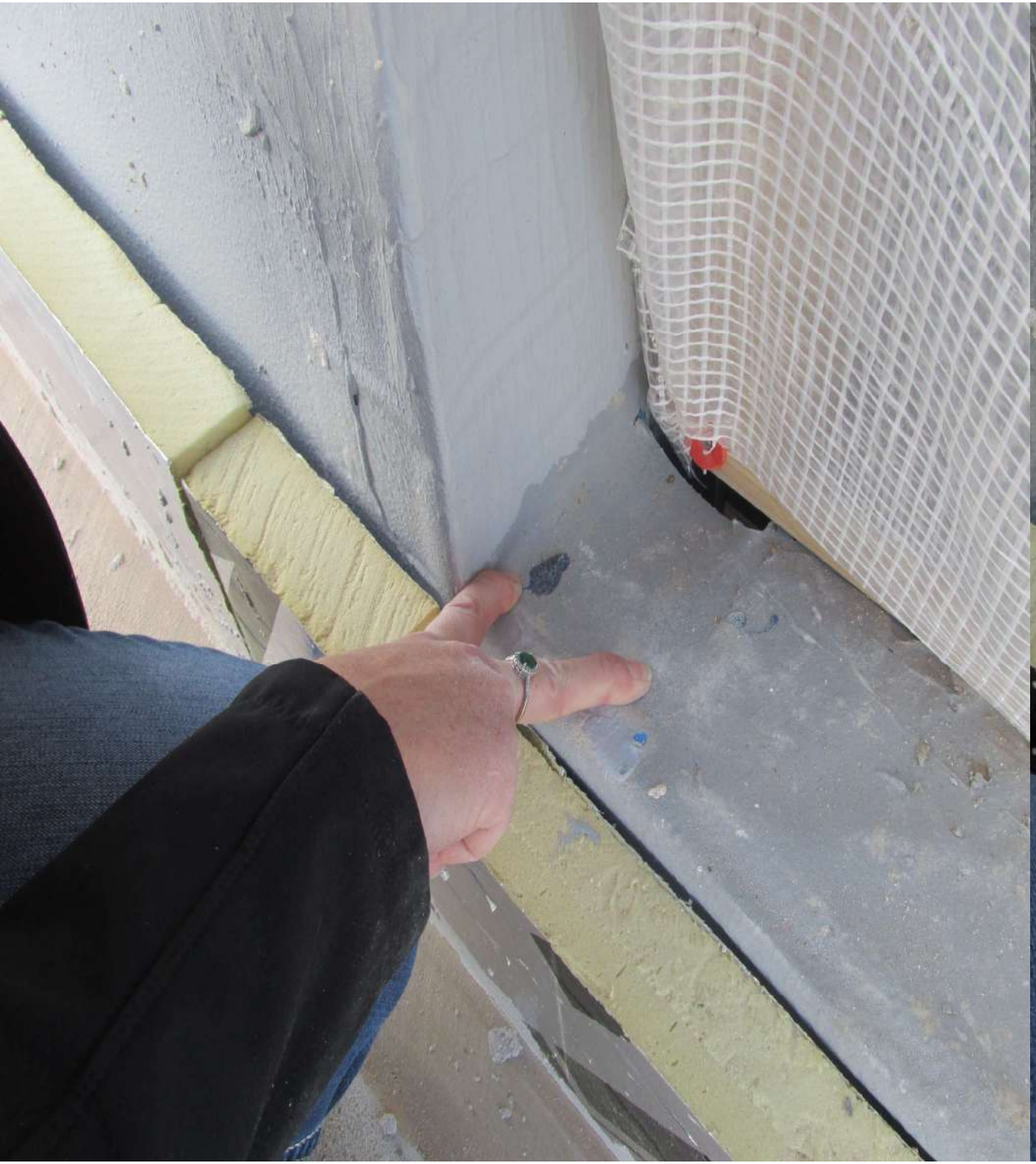
- Understanding construction sequencing can also improve air barrier installations





Substrate Preparation

- One of the main culprits that can result in poor application
- Typically done by other trades with potentially no understanding of what is acceptable
- Depending on air barrier chosen, it can have a larger impact on the long-term performance

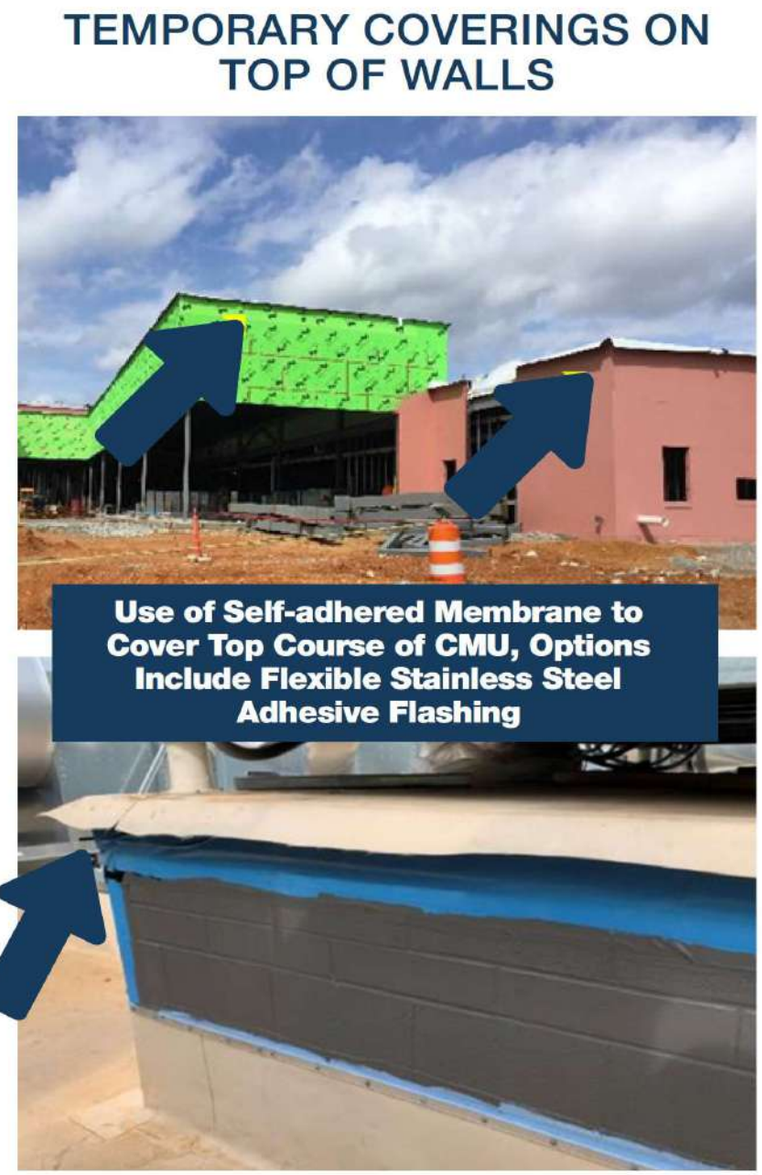


Concrete Masonry Units (CMU)

- Clean
- Dry
- Properly Primed (if required)

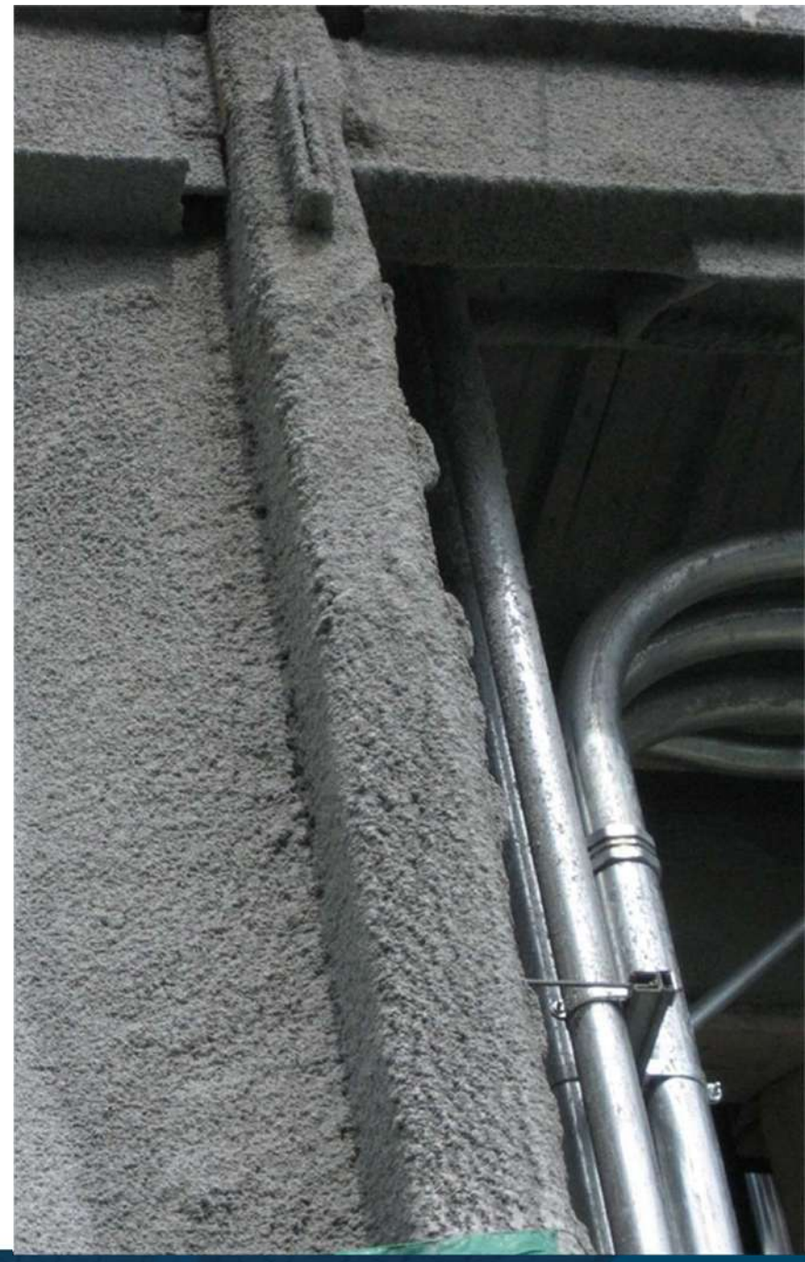
Photo courtesy of Corey Zussman

Photo courtesy of Corey Zussman



Concrete Masonry Units (CMU)

- Keep it from getting wet in the first place!
- Roof or other strategies for protection



Concrete Masonry Units (CMU)

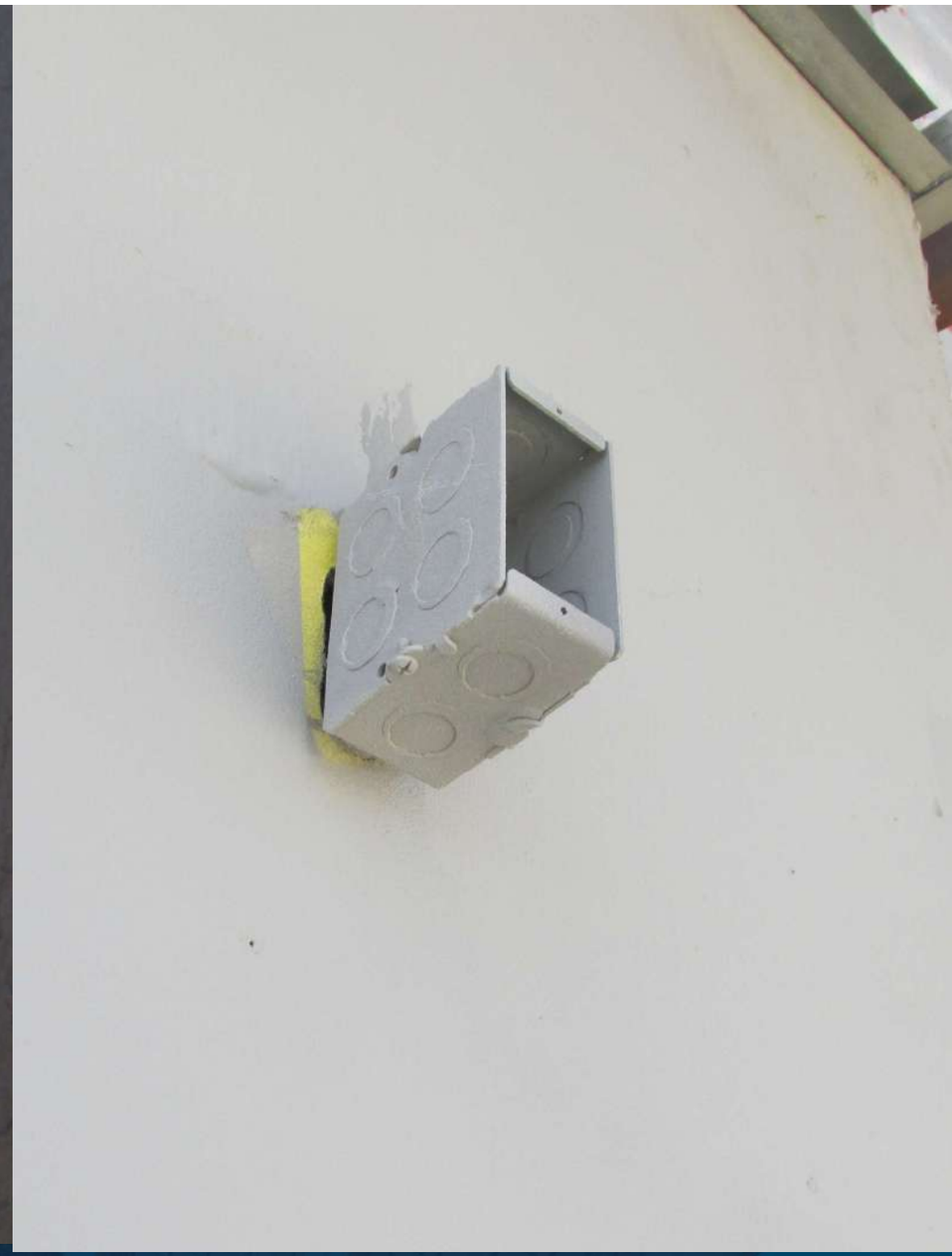
- Significant Gaps
- Fireproofing Overspray
- Efflorescence

Exterior Gypsum

- Clean
- Dry
- Properly Primed (if required)

Exterior Gypsum

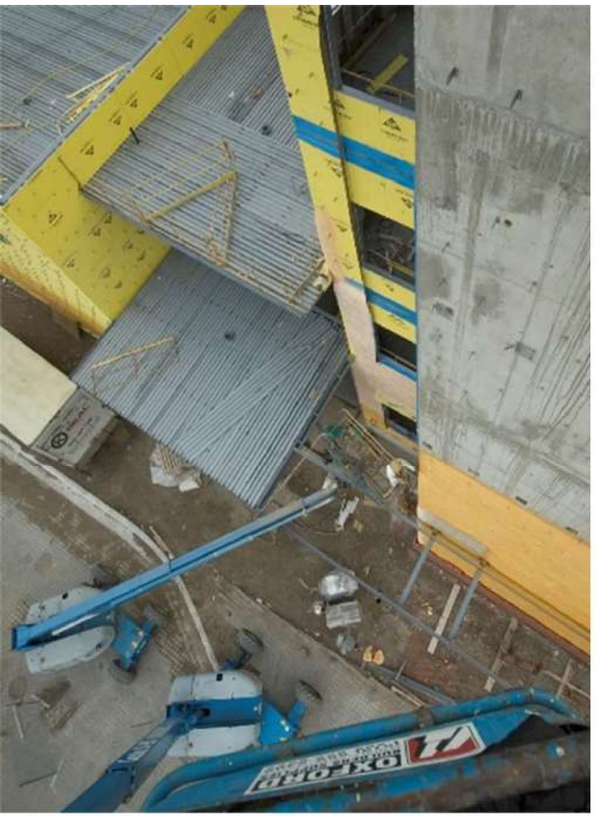
- Significant Gaps in Sheathing
- Over/Under driven fasteners
- Damage




www.tremcose
mco
AIR
www.tremcosealants.com

Poured Concrete

- Clean
- Dry
- Properly Primed (if required)





Poured Concrete

- Forming Oils
- Honey Combing
- Slurry
- Rough Form Joints

Wood

- Really same items as exterior gypsum (clean, dry, moisture content)
- Fasteners under/over driven
- Gaps between sheathing

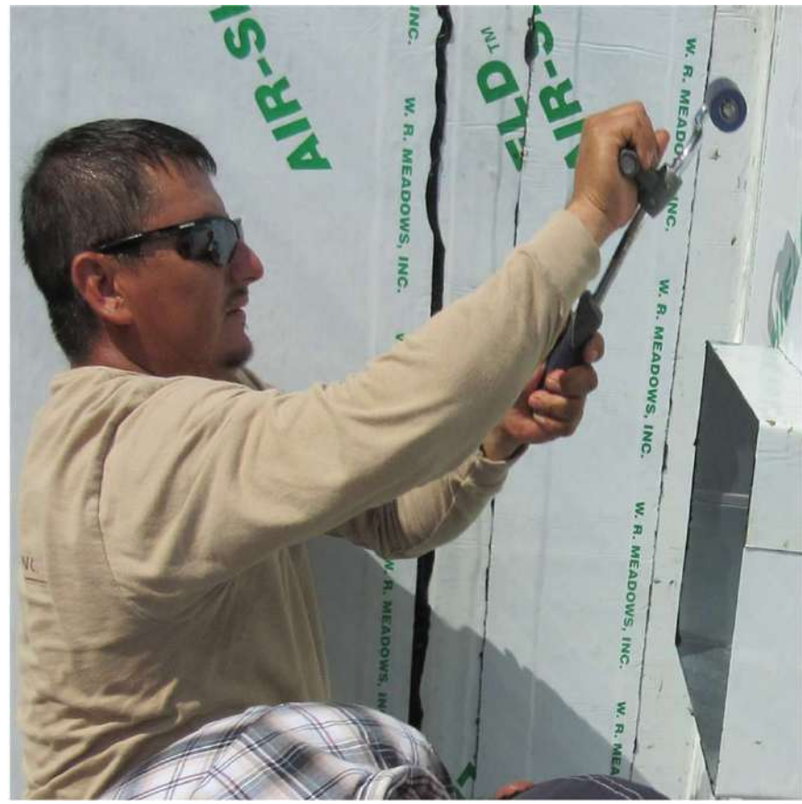
What do we look for ?

Self-Adhered Membranes



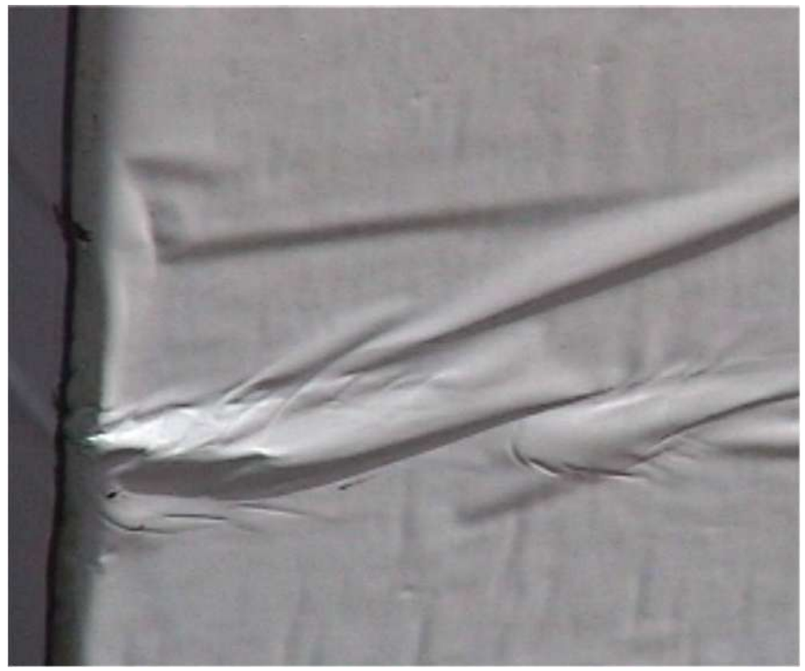

Self-Adhered Membranes

- Proper overlap of joints and seams
- Seal around all penetrations with mastic/sealant
- Provide backing at deflection and control joints
- Do not span gaps larger than recommended by manufacturer



Self-Adhered Membranes

- Rolled membrane to enhance adhesion
- Proper priming (if required)
- Proper Integration and connections to windows, roof, floor-to-floor, expansion and cold joints, etc.



Self-Adhered Membranes

- Wr
- Un
- Ov
- Mc
- Im

What do we look for ?

Fluid Applied Membranes

Proper thickness = Proper performance

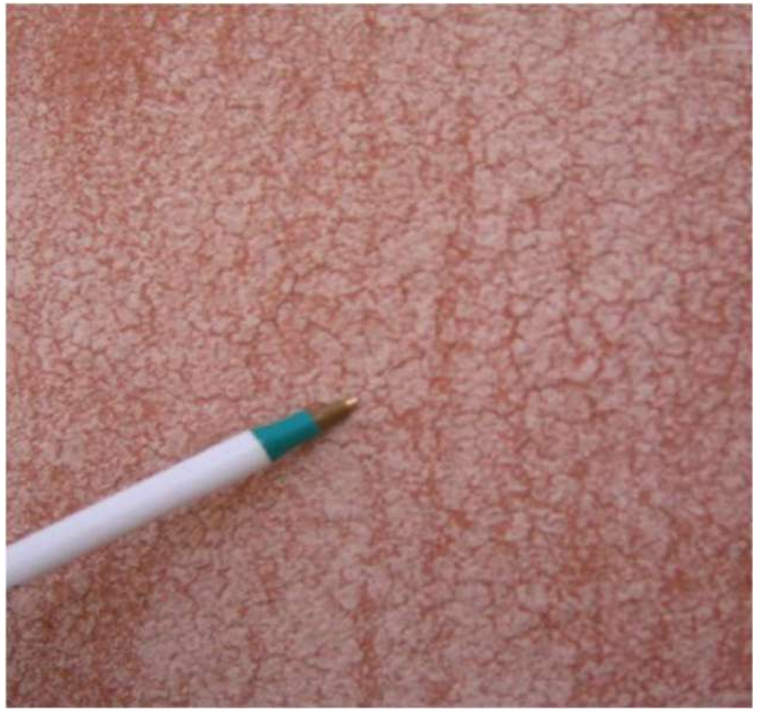
- Specified thickness
- Installed thickness
- Manufacturer thickness

Fluid Applied Membranes

- Ensure all detailing is completed.
- Watch temperature limitations for application (various technologies)
- Spray evenly and consistent and avoid slumping of material
- Ensure thickness meets specifications and manufacturers instructions

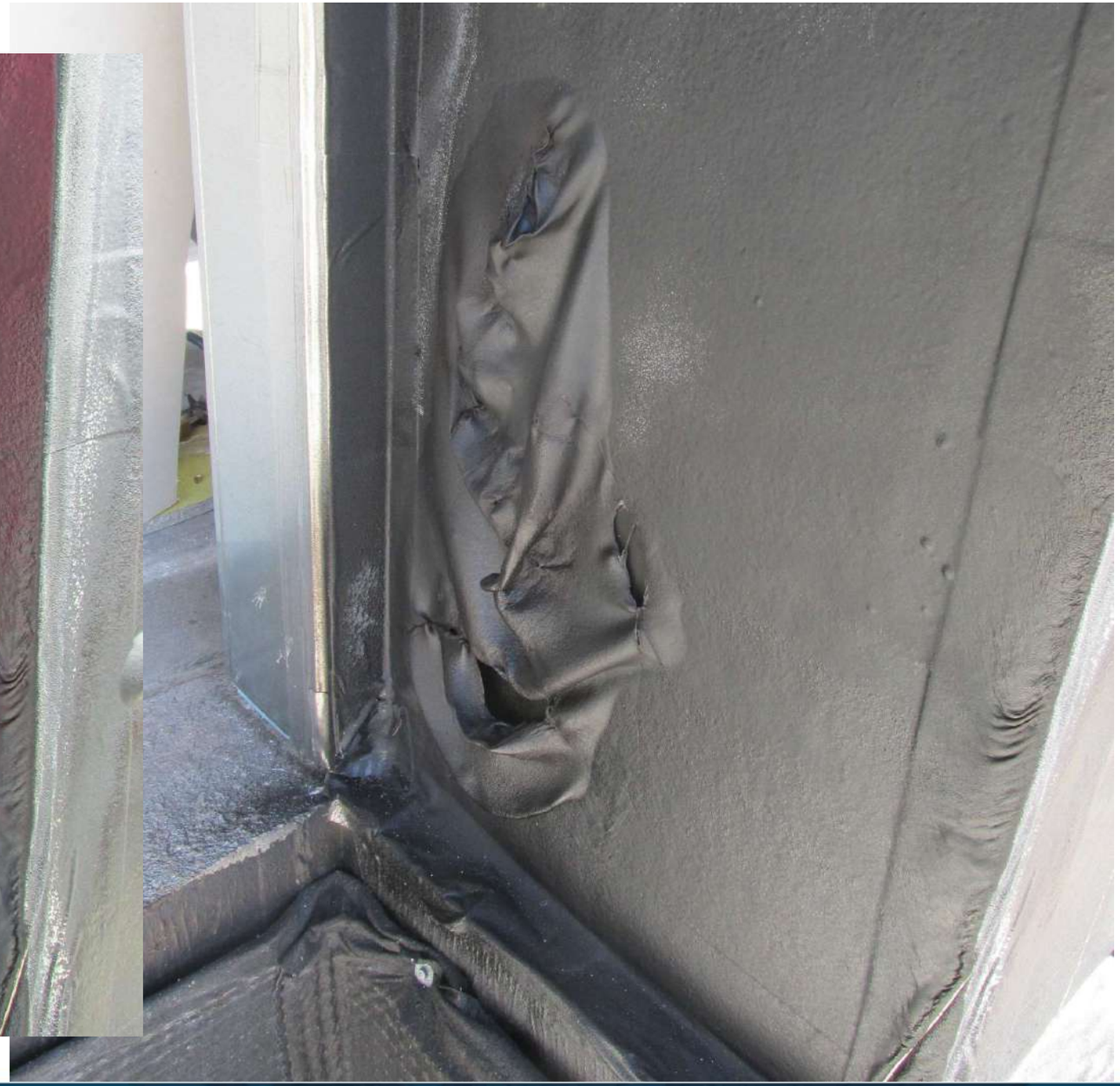
Fluid Applied Membranes

- Substrate Prep is even more important with these systems (smooth surface, masonry joints struck flush, board joints treated)
- These do take some time to cure, so beware of environmental conditions
- Monitor overspray in windy conditions or urban area's



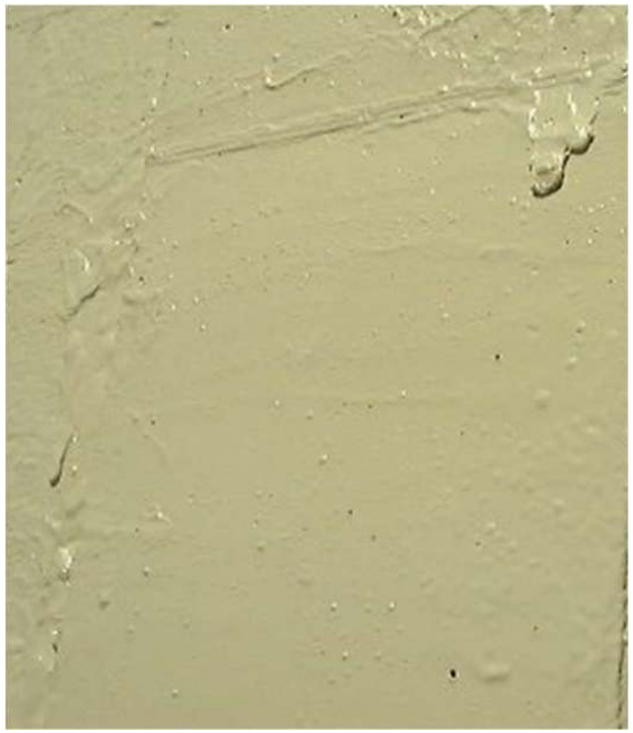
Fluid Applied Typical Field Issues

- Extended Exposure to UV
- Exposed to very high temperatures
- Adhered to transition material



Fluid Applied Typical Field Issues

- Blisters due to moisture in substrate
- Unadhered Transition Membranes



Fluid Applied Typical Field Issues

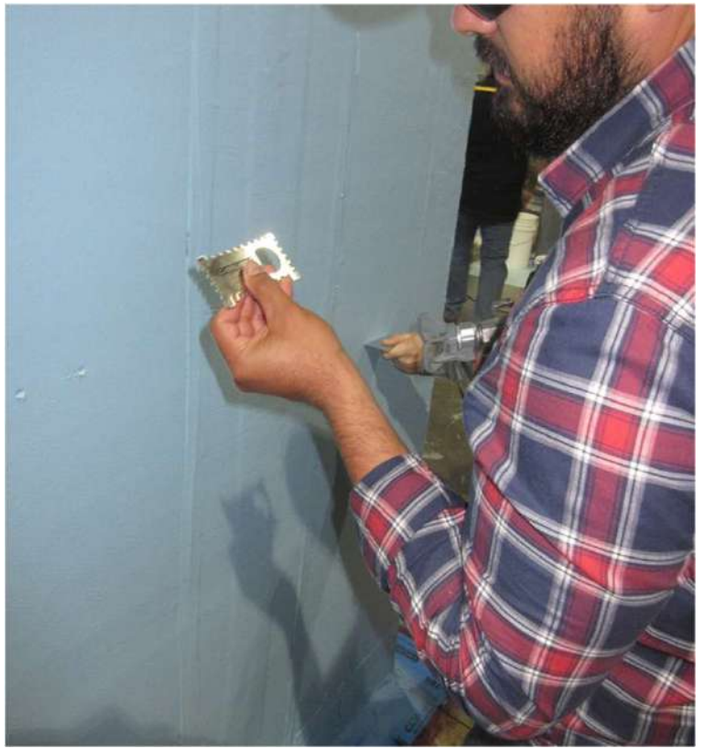
- “Shadow” effect around masonry ties
- Pinholes & Fish-eyes

Fluid Applied Typical Field Issues

- Cratering
- Cracking
- Improper Material Storage

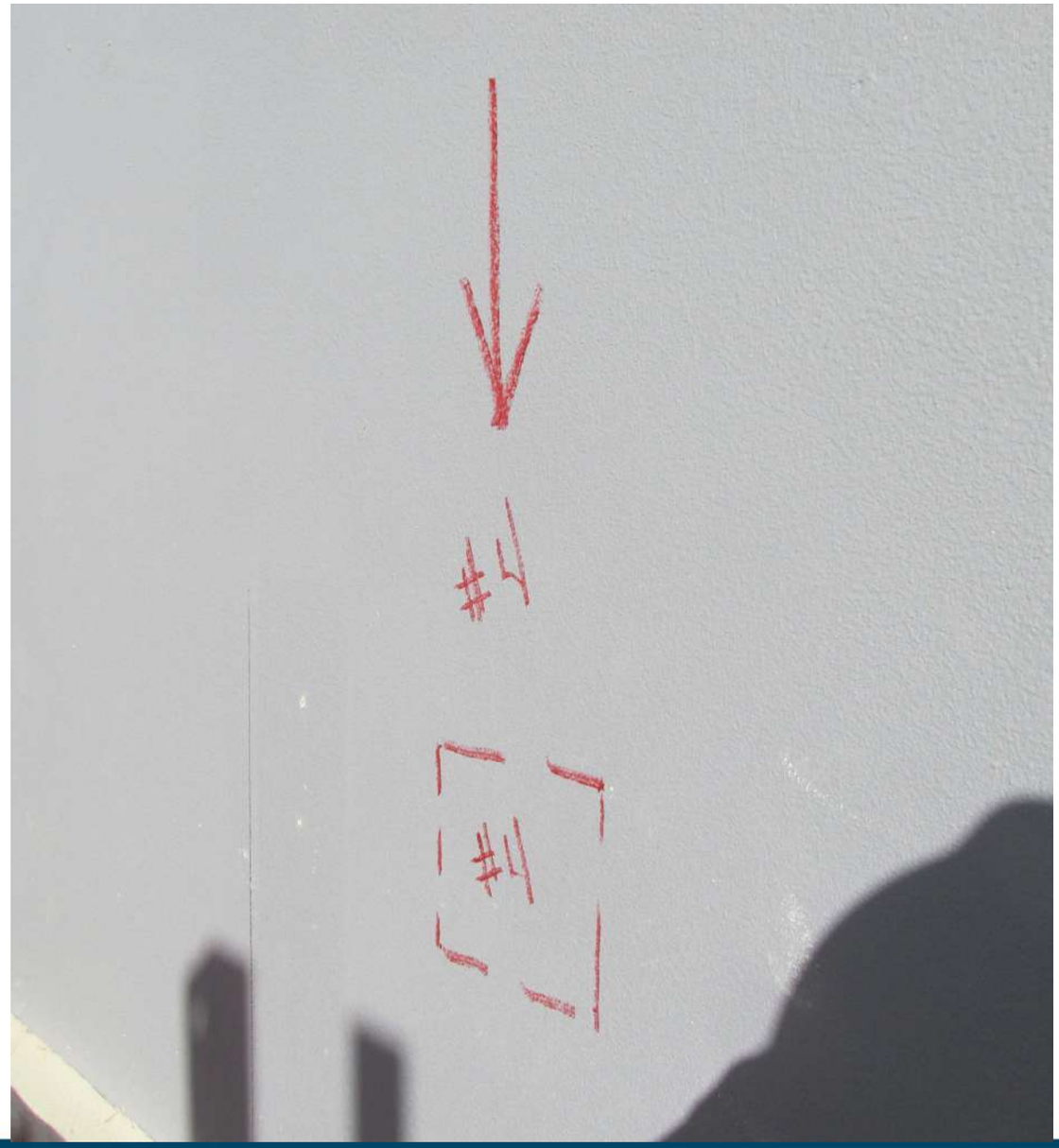
Fluid Applied Typical Field Issues

- Material Slumping



Fluid Applied Typical Field Issues

- Improper Thickness




mm/inch
0.037
ZERO
#5

What do we look for ?

Sprayed Polyurethane Foam

Sprayed Polyurethane Foam

- Be aware of environmental conditions for temperature and relative humidity
- There are specific Health and Safety of sprayers and others on-site
- Specialized equipment to pump, provide pressure, heat and mixing has a large impact on the application

Sprayed Polyurethane Foam

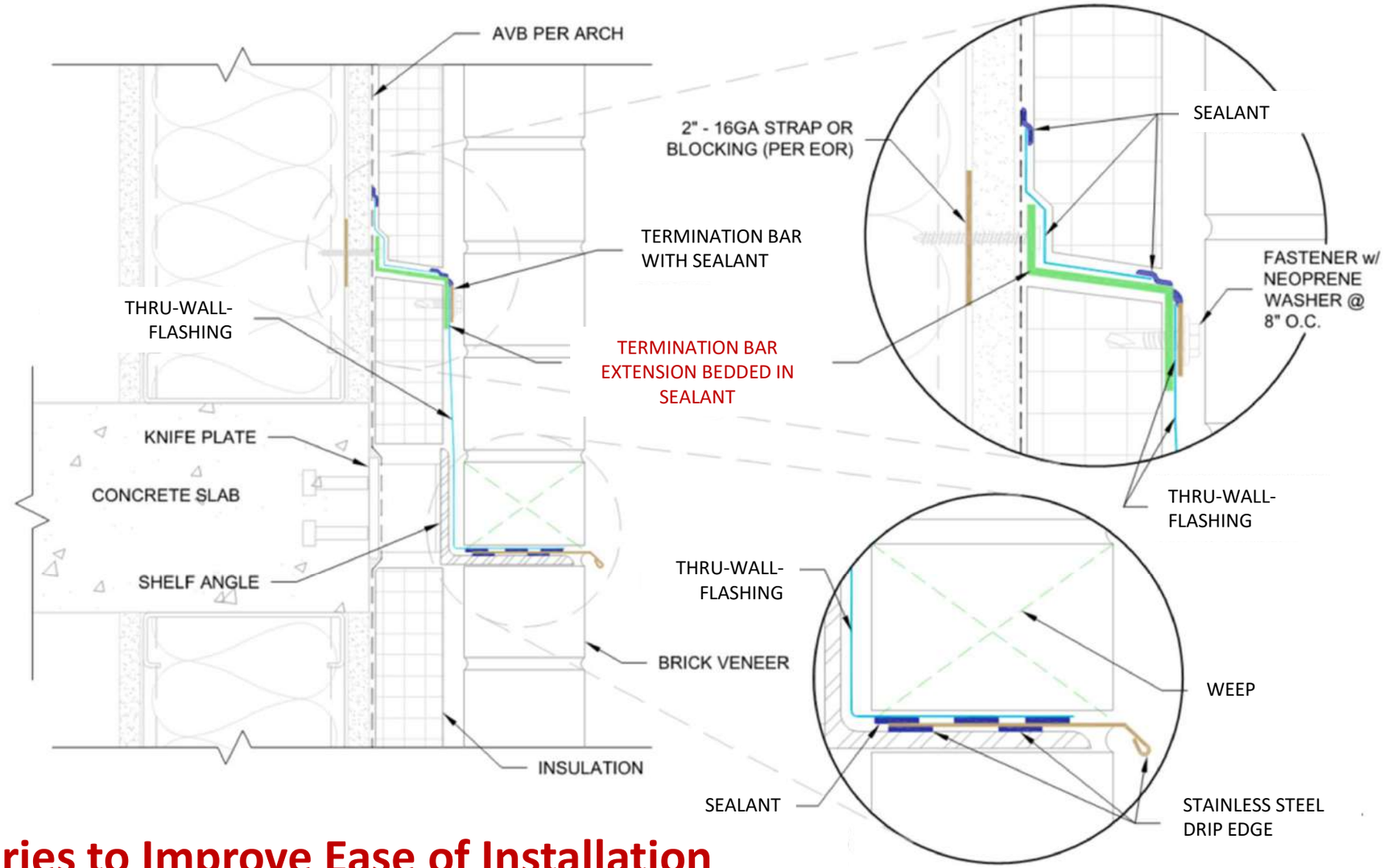
- Transition Membranes are Required to tie into other components and assemblies
- Make sure they stick !!

the construction specifier
The Official Magazine of CSI

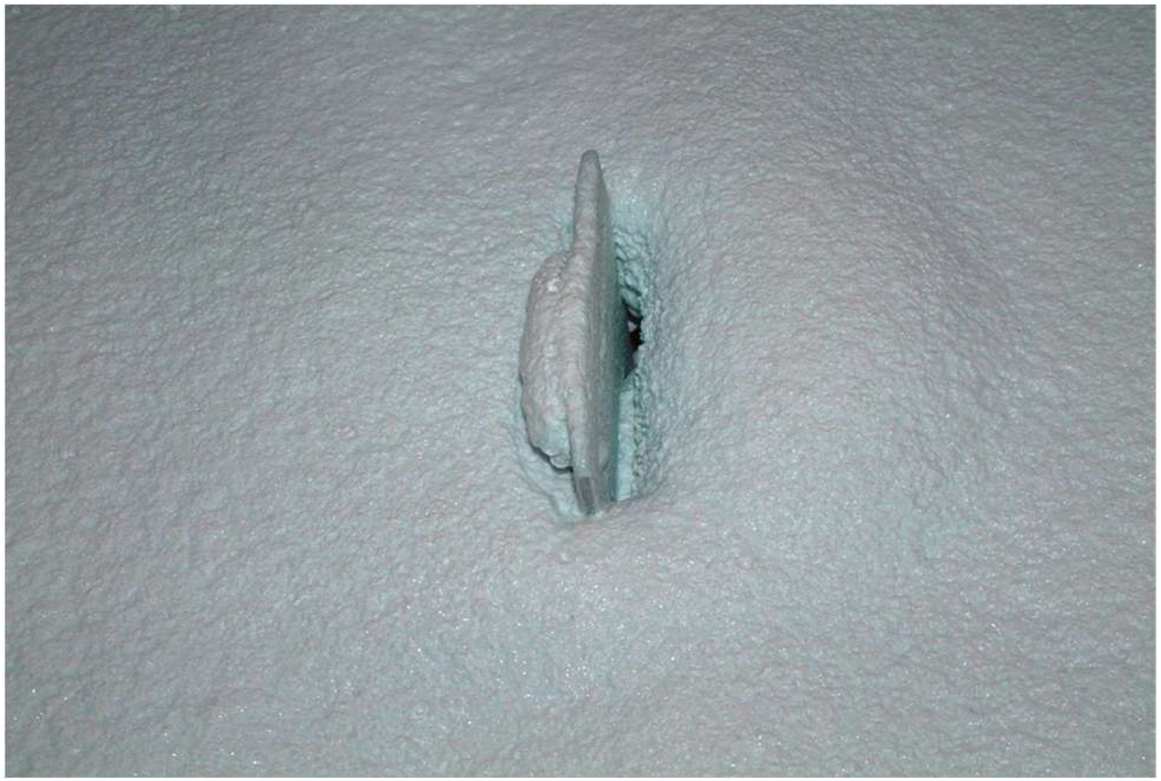
CSI
CONSTRUCTION SPECIFICATIONS INSTITUTE

Image 3 of 3 - Creating a continuous air barrier from the wall to the shelf angle with a stainless steel flashing. The author also installed a spray polyurethane foam (SPF) solid under the stainless steel flashing to reduce the condensation potential under the flashing.

Credit to: Corey Zussman
June 1, 2021
Construction Specifier CSI
The air barrier pre-installation meeting



Accessories to Improve Ease of Installation



Sprayed Polyurethane Foam Typical Field Issues

- “Shadow” effect around brick ties
- Look for smooth application

Sprayed Polyurethane Foam
Typical Field Issues

- Thickness is important, just like fluid applied
- Ensure it is not “too thick” to hamper installation of other components

Sprayed Polyurethane Foam
Typical Field Issues

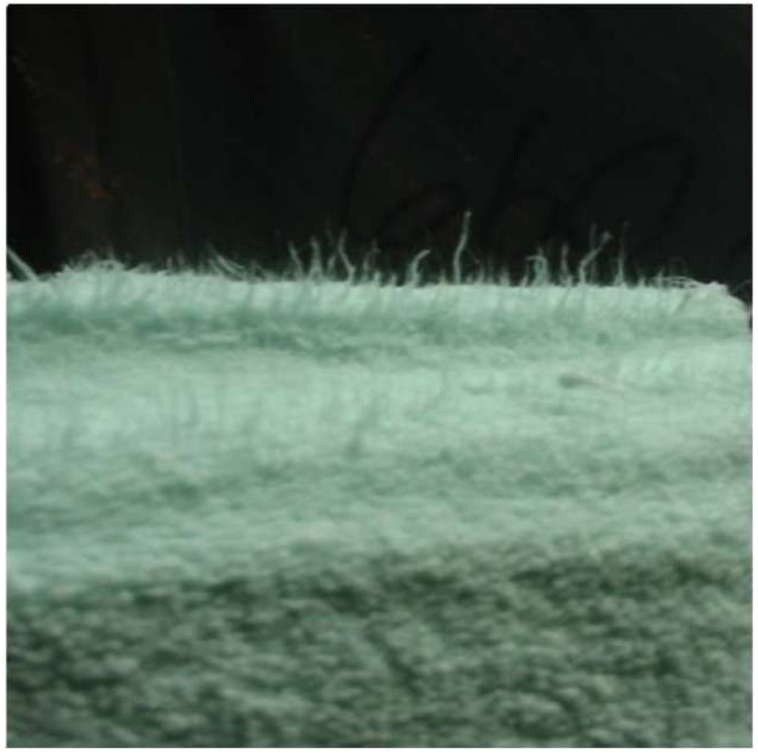
- Adhesion or Cohesion failure

Sprayed Polyurethane Foam Typical Field Issues

- Off-ratio (Resin Rich or Iso Rich)

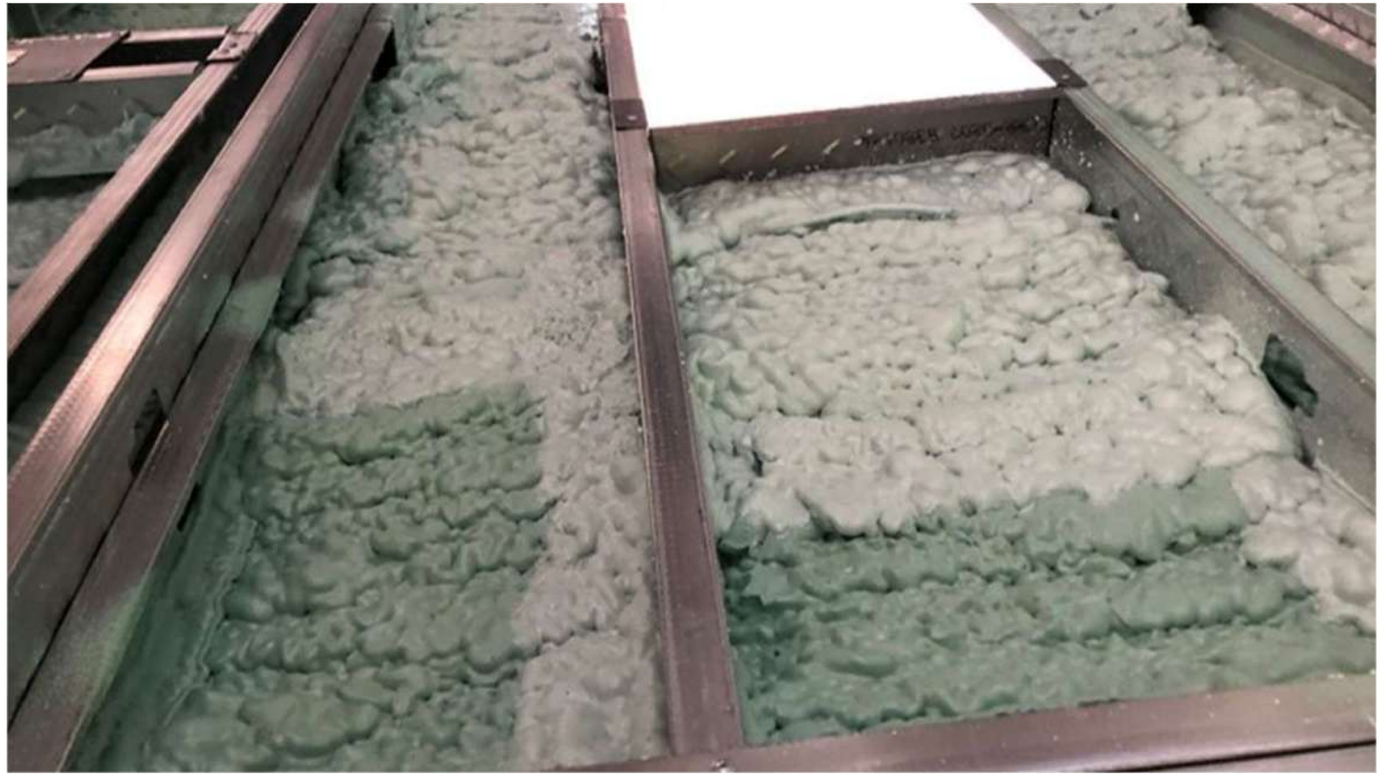
Sprayed Polyurethane Foam
Typical Field Issues

- Thermal Cracking



Sprayed Polyurethane Foam
Typical Field Issues

- Poor Cell Structure



Sprayed Polyurethane Foam
Typical Field Issues

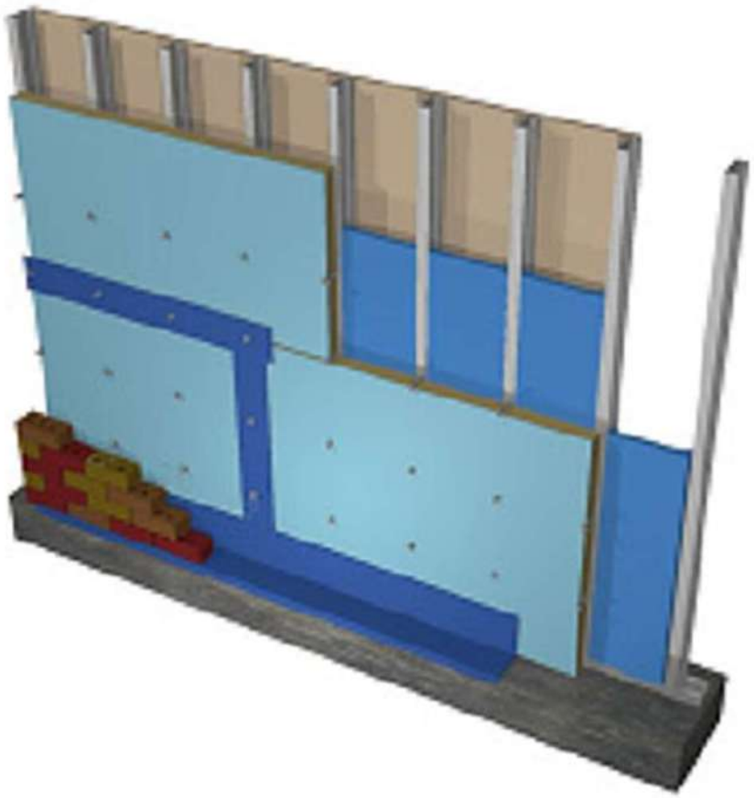
- Applicator skill
- Too hot, too cold when spraying

Sprayed Polyurethane Foam - Testing

- Density – indication of proper application

What do we look for ?

Insulating board stock



Insulating Board Stock

- Use of tape’s, sealants and membranes to connect insulation board together

Insulating Board Stock Typical Field Issues

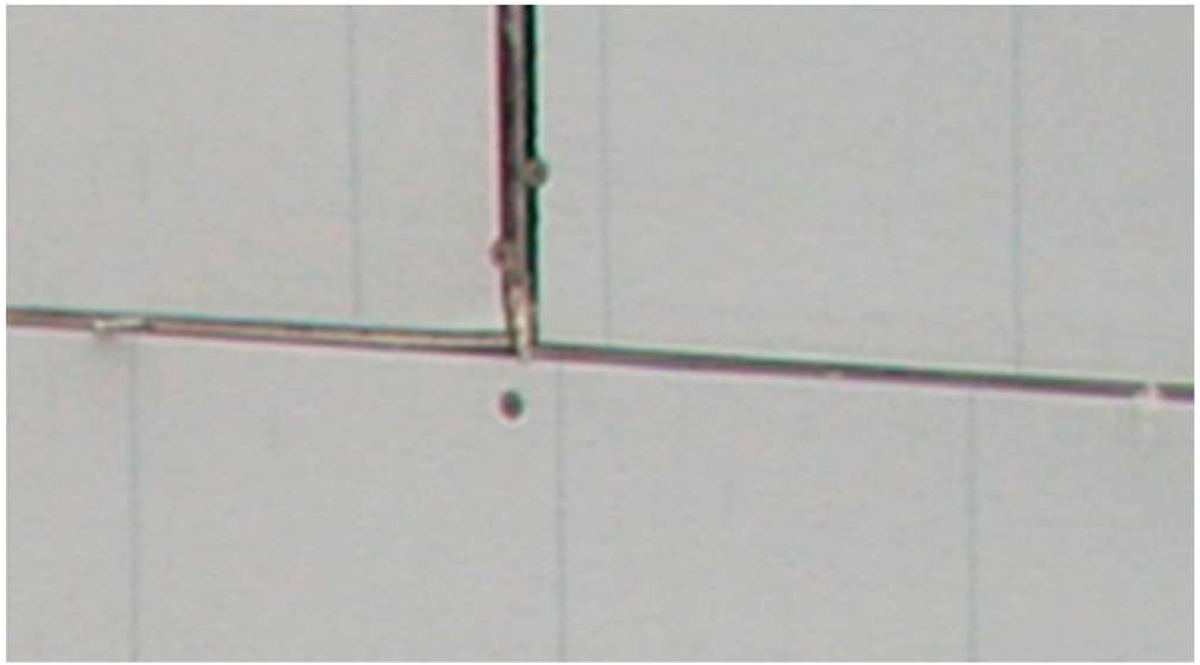
- Adhesion of tapes to board joints
- Improper fasteners or sealants used
- Penetrations installed after application

What do we look for ?

Non-insulating board stock

Non-Insulating Board Stock

- Use of tape's, sealants and membranes to connect
  - **(1) factory bonded membranes** or
  - **(2) sheathing products** that are connected using air barrier accessories



Non-Insulating Board Stock Typical Field Issues

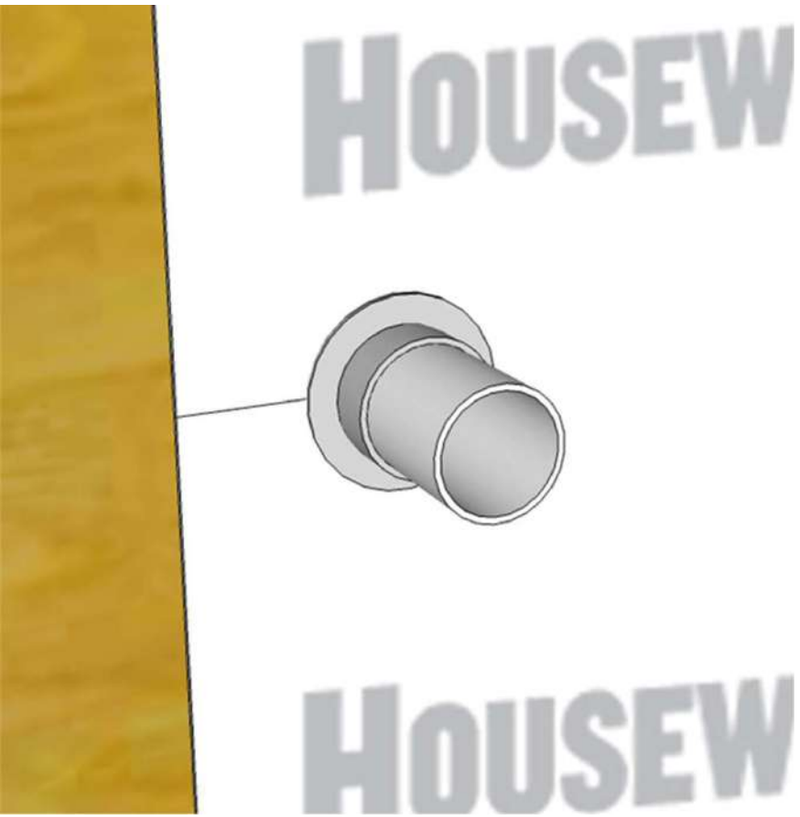
- Adhesion of tapes to board joints
- Improper fasteners or sealants used
- Penetrations installed after application

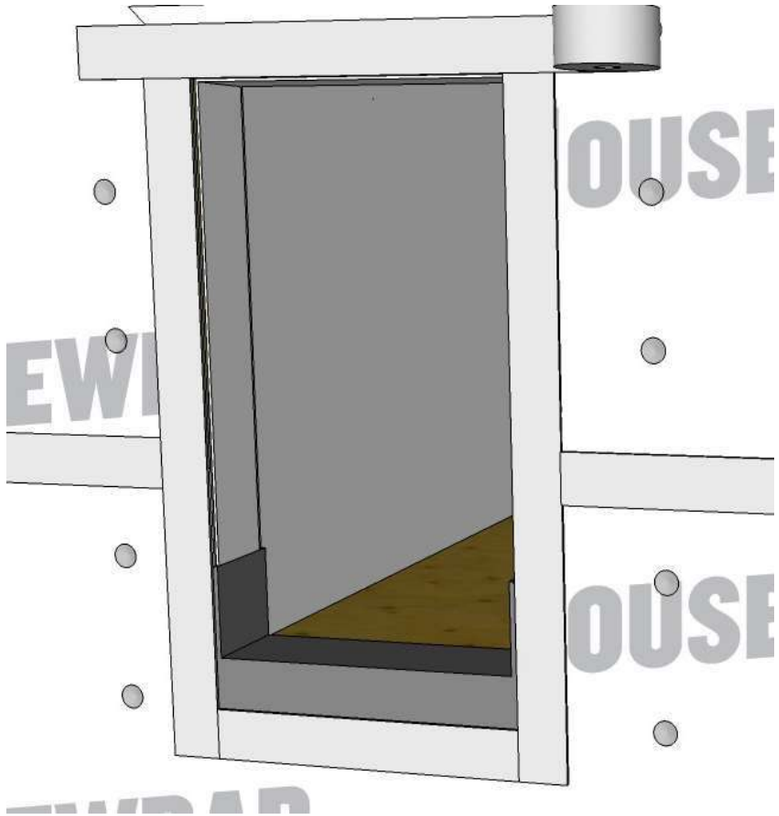
Non-Insulating Board Stock
Typical Field Issues

- Stud fasteners
- Transition to below grade
- Water intrusion during construction

What do we look for ?

Commercial Building Wrap





Commercial Building Wrap

- Require Proper Fasteners and Fastening Pattern
- Proper overlap or seams, joints and corners
- All seams taped
- Integration with flashing at windows, door, penetrations, etc.

Commercial Building Wrap
Typical Field Issues

- Damage and tears during construction
- Installation over sharp objects
- Using incorrect fasteners
- Lack of Integration into windows and door rough openings

Physical Testing Adhesion

For materials that rely on an adhesive

abaa building enclosure conference

ADHESION OF AIR BARRIERS TO SUBSTRATE

- Determine the adhesion values needed for a material when installed on a substrate

- Current material evaluation requirements for lab testing for manufacturers is a minimum of 16 psi

ADHESION OF AIR BARRIERS TO SUBSTRATE

Many field related low adhesion values are related to a variety of factors:

- Poor substrate preparation
- Installation outside parameters of proper installation
- The type of substrate

ADHESION OF AIR BARRIERS TO SUBSTRATE

- New Test Method Developed Specific to Air Barriers

cope

This test method provides a method for evaluating the pull-off (adhesion) strength (may also be nsidered tensile stress) of adhered air and water resistive barriers on rigid substrates. The test mines the greatest perpendicular force (in tension) that the surface area of the material can bear. re will occur along the weakest plane within the system comprised of the disc, adhesive, air/water barrier material, and substrate.

method determines tensile stress in contrast to other adhesion test methods (such as shear ts) which measures other stress components and results are not comparable between test

od uses a class of apparatus known as pull-off adhesion testers. They can apply a counter load to a single surface so that material can be tested even though only one ximum measured load is limited by the strength of the bond between the disc

PRACTICE	ASTM D4541	ASTM D7234	ABAA 0002
Scoring around Specimen	Referenced Device: Scoring tool or circular hold cutter, or similar tool. May be required for thick-film, reinforced, and elastomeric coatings. When performed, use extreme care and clearly report with results. Ensure cut is normal to coating surface in manner that does not twist or torque test area and minimizes heat generation, edge damage, or microcracks.	Referenced Device: Core bit with drill press or hand drill. Required for coating thicker than 20 mils and for all reinforced and elastomeric coatings. Recommended for coating thinner than 20 mils. Ensure cut is normal to coating surface in manner that does not twist or torque test area and minimizes heat generation, edge damage, or microcracks.	Referenced Device: Utility knife or circular hole cutter Scoring of AWB around loading fixture is explicitly included in procedure. When using circular hole cutters, to avoid friction resulting in torsion applied to the bond interface and heat generation, a cutter with a kerf at the cutting edge is suggested.
Maximum Load Rate	150 psi/sec	30 psi/sec	0.97 psi/sec (58 psi/min) or 6 crank revolutions/min
Maximum Test Duration	100 sec	30 sec	Not specified
Definition of Failure (Termination of Test)	Test is completed when fixture detaches from substrate, pass/fail criteria is met, or maximum pull strength for instrument is reached.	Record force attained at failure. Failure is not explicitly defined.	Record force attained at failure. Failure is not explicitly defined.
Number of Tests	At least 3 replications to statistically characterize a test area.	At least 3 replications to statistically characterize a test area.	At least 3 replications to statistically characterize a test area (39 inches by 39 inches). Three pulls shall be considered a single test.
Size of Loading Fixture	Not specified (Loading fixture descriptions for different types of portable adhesion testers provided in Annexes)	Not specified (Paragraph 6.1.1 states that round loading fixtures are usually 2 inches in diameter, but diameter may range from 0.75 to 3 inches)	2.25 inch diameter Minimum thickness: 6 mm (metal) 15 mm (plywood)

ADHESION – ASTM D4541 vs ABAA

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Conclusion

- Site Observation and Site Quality Control are only one tool in the tool kit to achieve quality installations.
- If we understand the recurring issues, the focus can become pro-active vs reactive.
- Substrate conditions continue to place a significant field related issue for materials that rely on adhesion.
- If we can understand the why, the how and the fix, we can address 90 % of the issues fairly quickly.

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Midwest Enclosure Consulting, LLC
Mitigating Risks. Every Step Of The Way.

abaa EDUCATION


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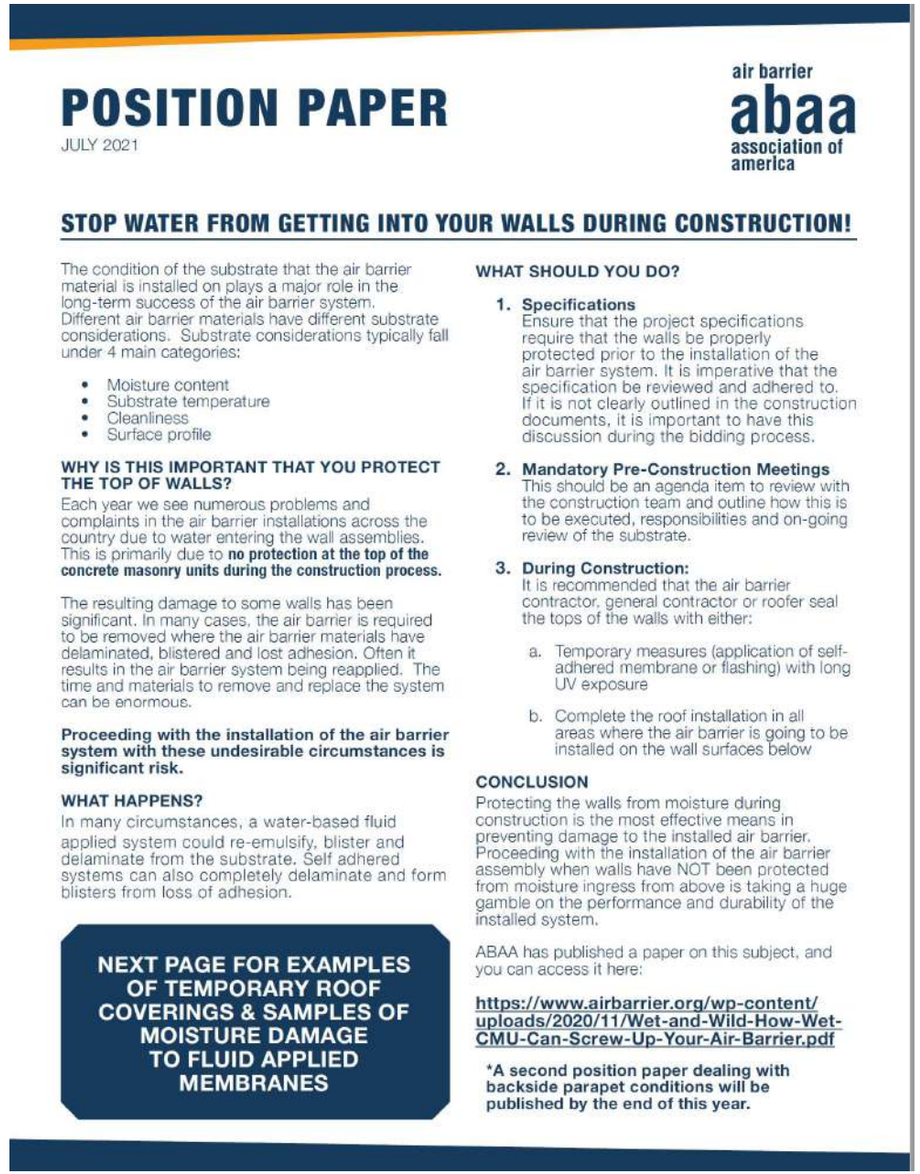
enclosure
conference

Free ABAA Resources

- ABAA Position Papers on Installation
- Sample Audit reports for various types of air barriers
- Sample Daily work records that can be used for quality control and documentation
- More education on design, testing, materials and about anything else related to the air barrier industry



POSITION PAPER

JULY 2021

air barrier abaa association of america

STOP WATER FROM GETTING INTO YOUR WALLS DURING CONSTRUCTION!

The condition of the substrate that the air barrier material is installed on plays a major role in the long-term success of the air barrier system. Different air barrier materials have different substrate considerations. Substrate considerations typically fall under 4 main categories:

- Moisture content
- Substrate temperature
- Cleanliness
- Surface profile

WHY IS THIS IMPORTANT THAT YOU PROTECT THE TOP OF WALLS?

Each year we see numerous problems and complaints in the air barrier installations across the country due to water entering the wall assemblies. This is primarily due to **no protection at the top of the concrete masonry units during the construction process.**

The resulting damage to some walls has been significant. In many cases, the air barrier is required to be removed where the air barrier materials have delaminated, blistered and lost adhesion. Often it results in the air barrier system being reapplied. The time and materials to remove and replace the system can be enormous.

Proceeding with the installation of the air barrier system with these undesirable circumstances is significant risk.

WHAT HAPPENS?

In many circumstances, a water-based fluid applied system could re-emulsify, blister and delaminate from the substrate. Self adhered systems can also completely delaminate and form blisters from loss of adhesion.

NEXT PAGE FOR EXAMPLES OF TEMPORARY ROOF COVERINGS & SAMPLES OF MOISTURE DAMAGE TO FLUID APPLIED MEMBRANES

WHAT SHOULD YOU DO?

1. **Specifications**
   Ensure that the project specifications require that the walls be properly protected prior to the installation of the air barrier system. It is imperative that the specification be reviewed and adhered to. If it is not clearly outlined in the construction documents, it is important to have this discussion during the bidding process.
2. **Mandatory Pre-Construction Meetings**
   This should be an agenda item to review with the construction team and outline how this is to be executed, responsibilities and on-going review of the substrate.
3. **During Construction:**
   It is recommended that the air barrier contractor, general contractor or roofer seal the tops of the walls with either:
   a. Temporary measures (application of self-adhered membrane or flashing) with long UV exposure
   b. Complete the roof installation in all areas where the air barrier is going to be installed on the wall surfaces below

CONCLUSION

Protecting the walls from moisture during construction is the most effective means in preventing damage to the installed air barrier. Proceeding with the installation of the air barrier assembly when walls have NOT been protected from moisture ingress from above is taking a huge gamble on the performance and durability of the installed system.

ABAA has published a paper on this subject, and you can access it here:

https://www.airbarrier.org/wp-content/uploads/2020/11/Wet-and-Wild-How-Wet-CMU-Can-Screw-Up-Your-Air-Barrier.pdf

***A second position paper dealing with backside parapet conditions will be published by the end of this year.**