abaa 2026 building enclosure conference

# Sealing the Deal

## A Holistic Framework for Reliably Achieving High-Performance Airtightness

**Sherman Wai | M.Eng., P.Eng., CPHD., PHI Building Certifier**

RDH Building Science

AIA Continuing Education Provider

abaa EDUCATION

# Sealing the Deal: A Holistic Framework for Achieving High Performance Airtightness

## Learning Objectives

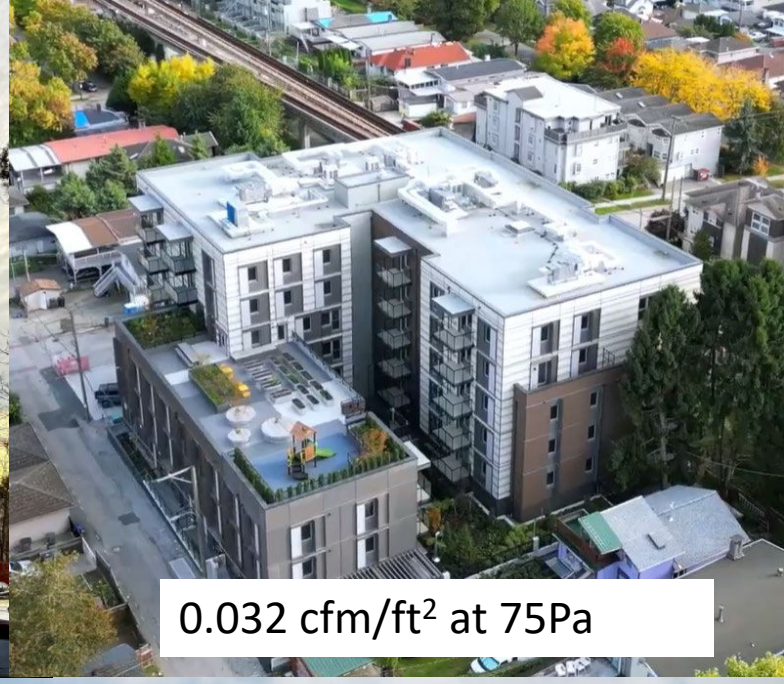
1. Describe why airtightness is important.
2. Identify the importance of the air barrier system as it relates to building enclosure design.
3. Identify the three key elements of high performance airtight construction.
4. Identify the responsibilities of an air barrier supervisor.

abaa EDUCATION

abaa building enclosure conference


0.062 cfm/ft$^2$ at 75Pa

0.079 cfm/ft$^2$ at 75Pa



0.032 cfm/ft$^2$ at 75Pa

0.051 cfm/ft$^2$ at 75Pa

0.077 cfm/ft$^2$ at 75Pa

# THE 3 KEYS TO AIRTIGHT BUILDINGS

1. DESIGN
2. BUILD
3. CONFIRM

# 1 How to Achieve Airtightness

DESIGN

# The 3 Keys To Airtight Buildings

## DESIGN

- → Clarity of documents
- → Material selection and assemblies
- → Details and interfaces that are buildable
- → Clear extents of air barrier system (pen test)
- → Design for airtightness

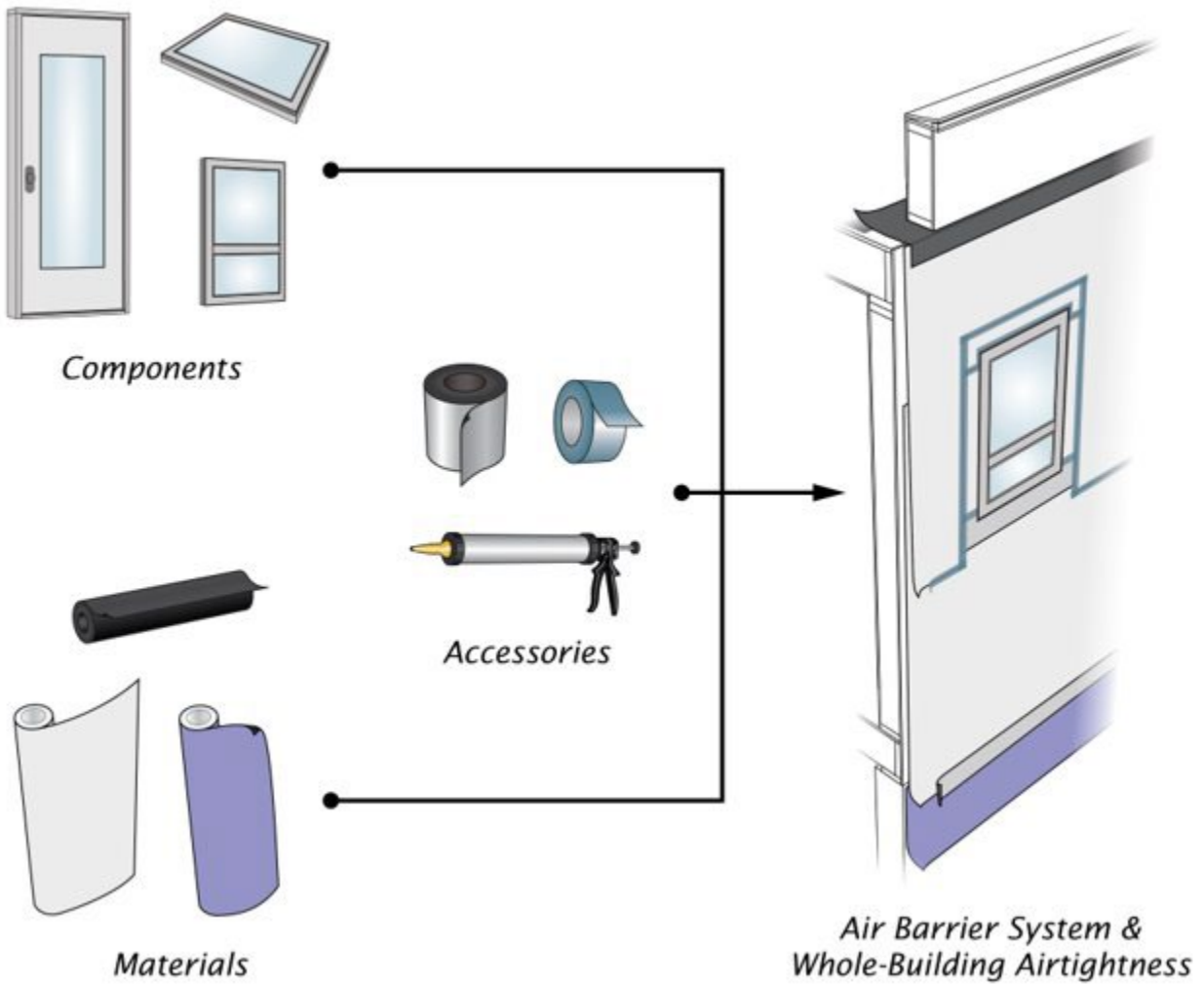
=

**MUST BE CONTINUOUS**

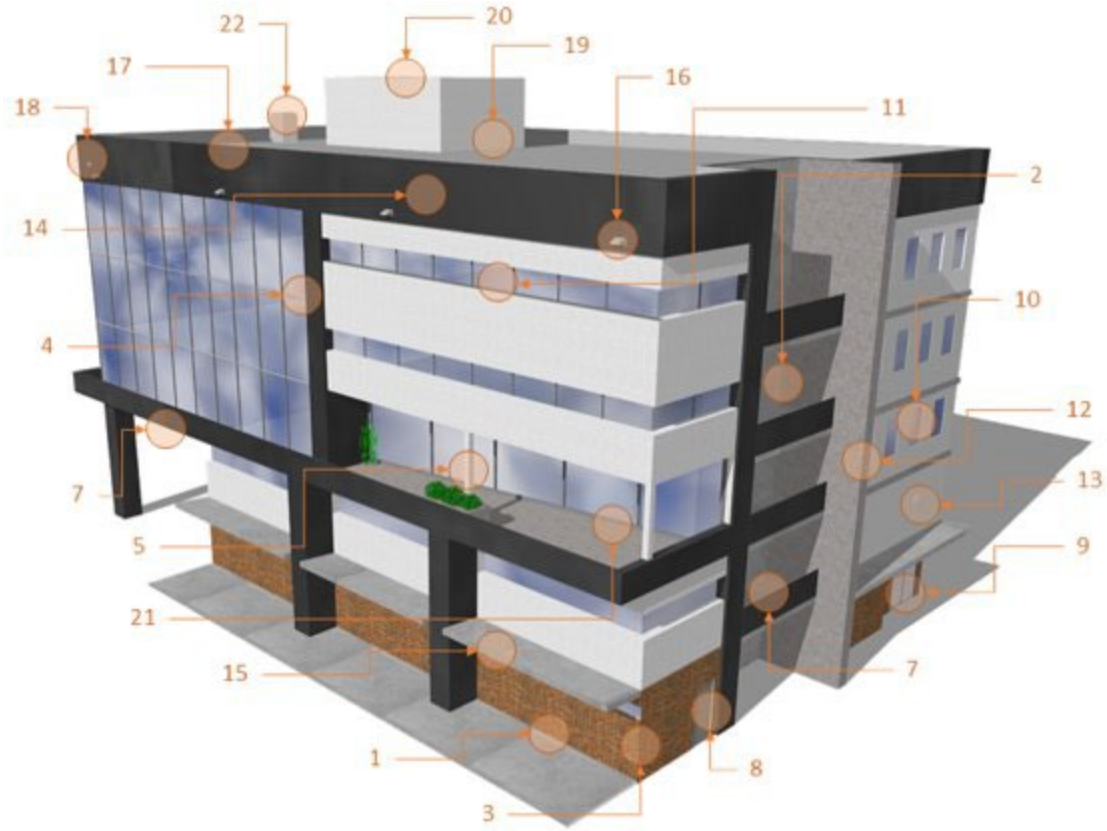
## BUILD

## CONFIRM

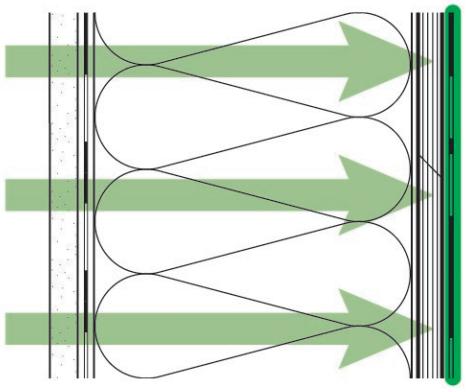
# Air Barrier as a System



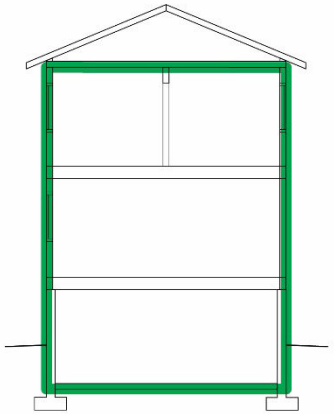
# Only As Strong as Weakest Detail



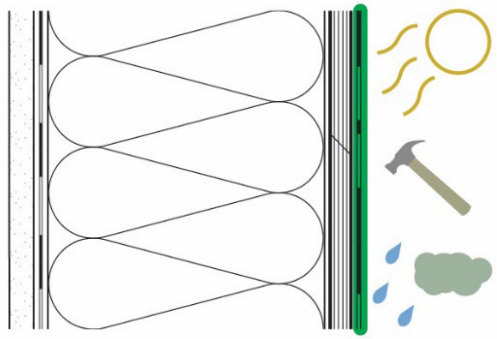
# Air Barrier System Criteria



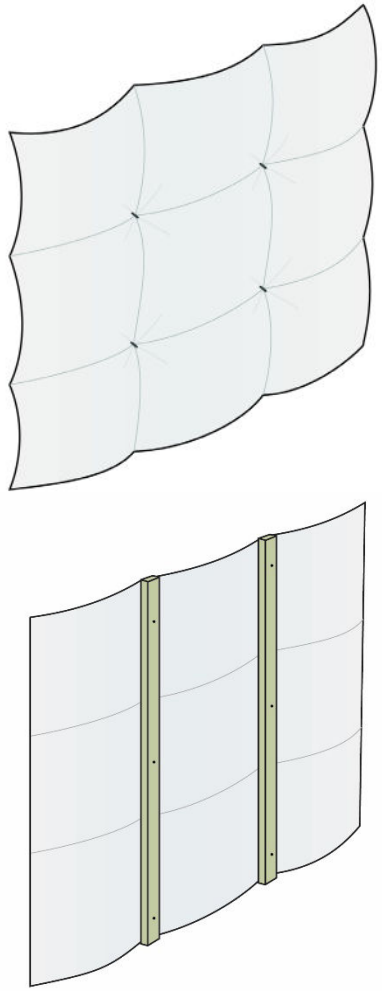
Air impermeable



Continuous

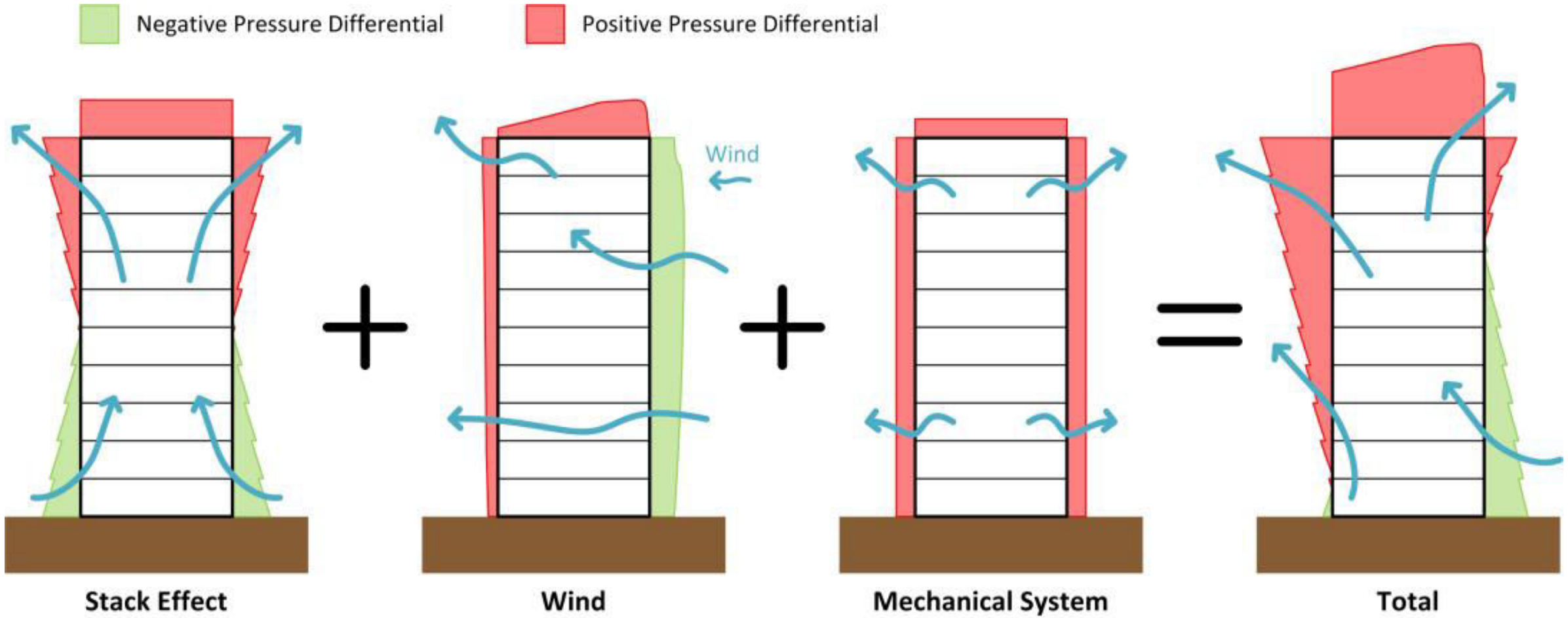


Durable



Strong, Stiff & Supported

# Loads on Air Barriers



# Clarity of Documents

**Requirement**

→ Clear performance targets

**Risk**

→ Back-and-forth process between design team, GC & trades to refine performance targets

**Responsibility**

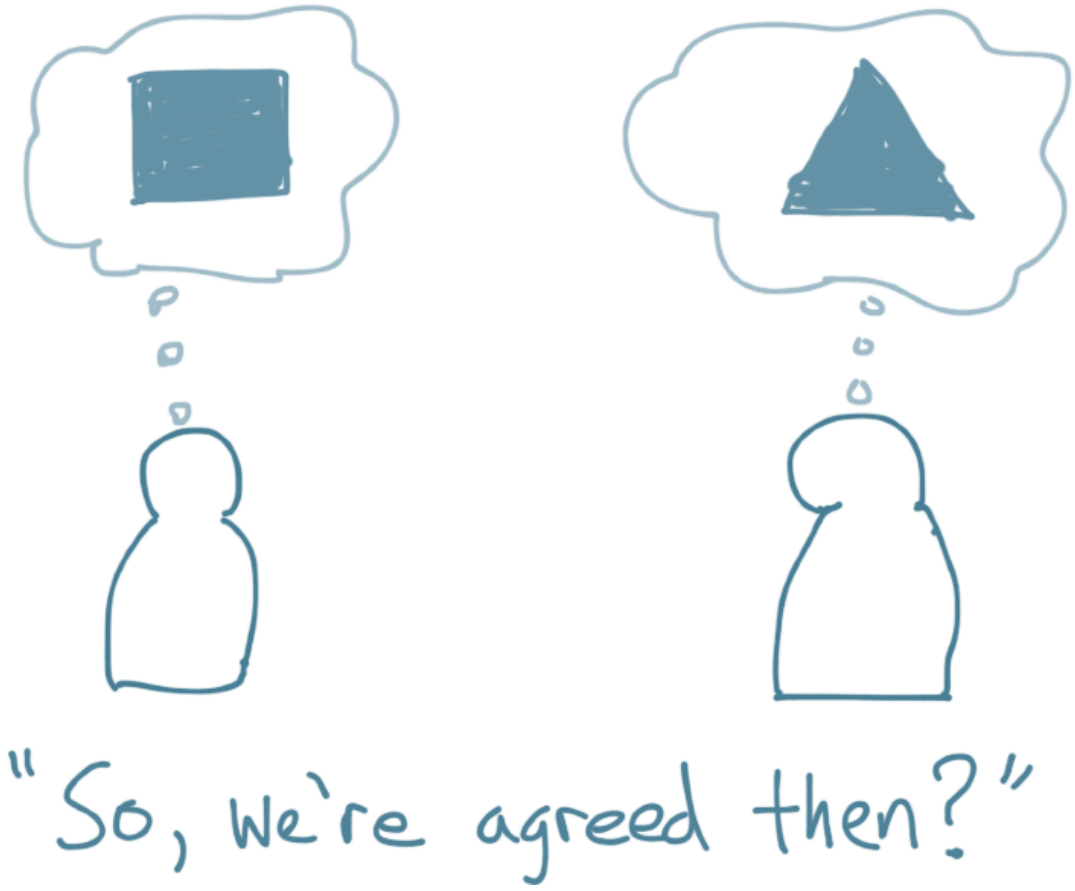
→ Design Team

**Tools**

→ Airtightness specifications

→ Drawing sets

→ PH Construction Verification Plan (Project specific)



# The “Pen Test”

AIR BARRIER SYSTEM EXTENTS

→ Must be continuous

→ Clearly identify elements of the air barrier system in details:

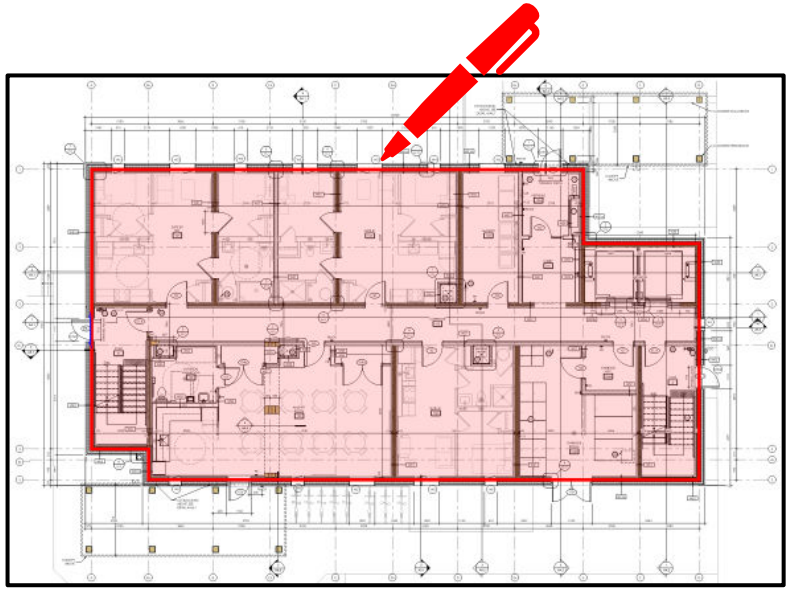
  → Membranes

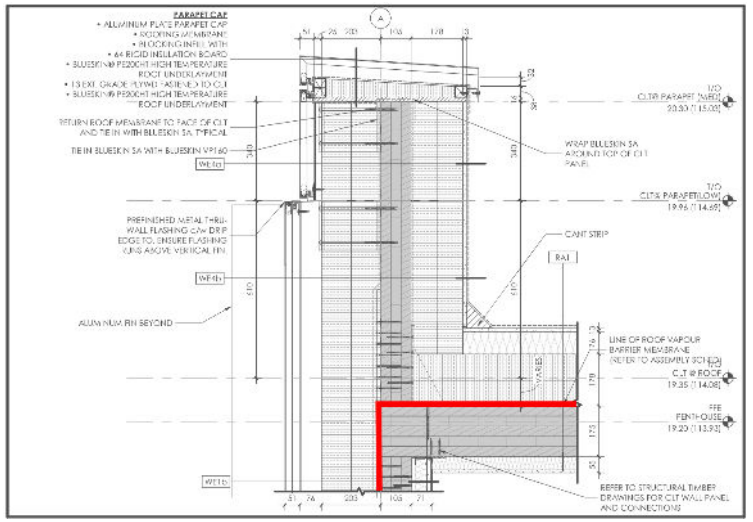
  → Sealant joints

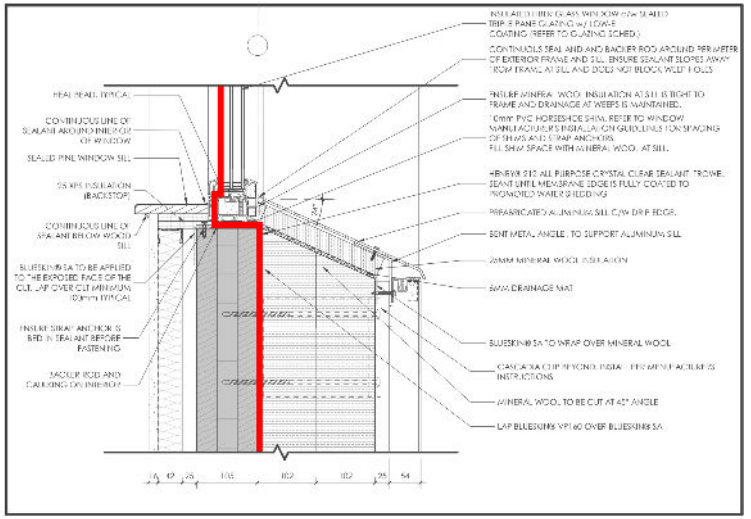
  → Tapes

  → Other transitions

→ Clearly communicate where the air barrier is to the contractor and trades



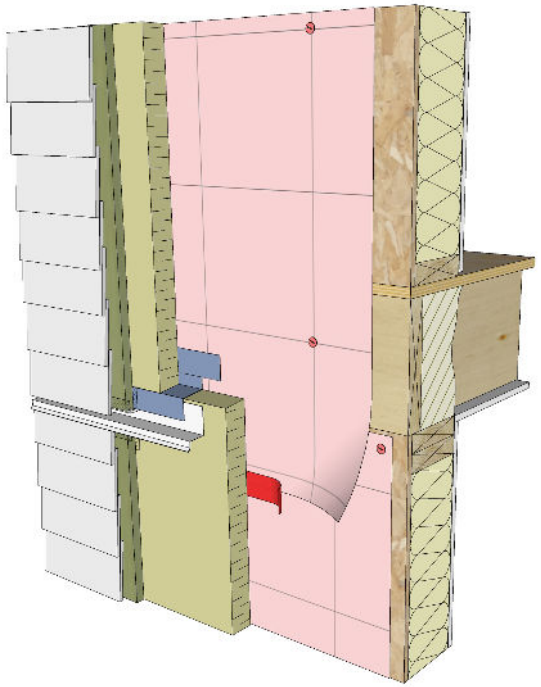




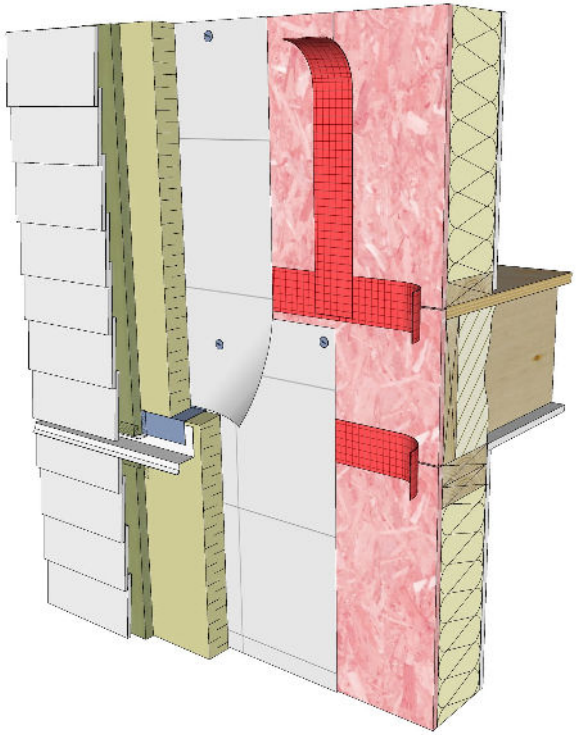
# Trending Framed Wall Air Barrier Approaches

Loose Air Barrier

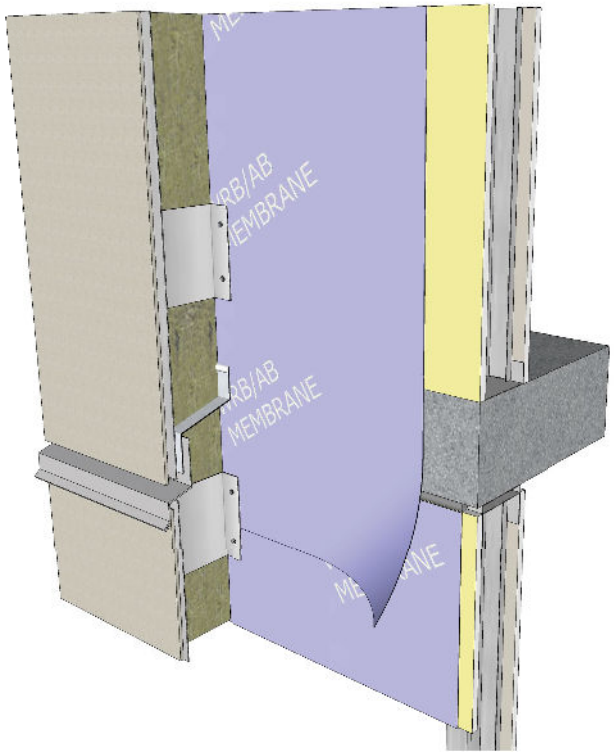
Rigid Air Barriers



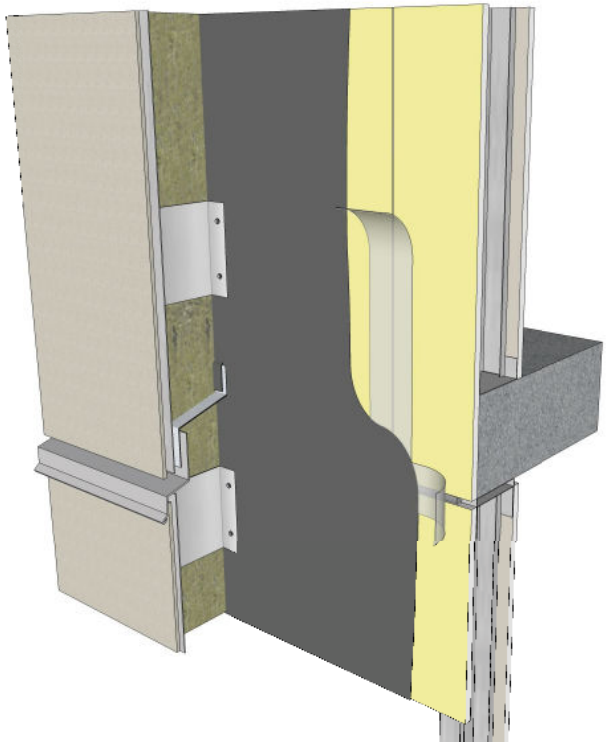
Mechanically Attached Sheet
(Sandwiched)



Sealed Sheathing
(Tape or Sealant)



Self-Adhered Membrane



Fluid/Liquid Applied Membrane

# Mechanically Attached House-wrap

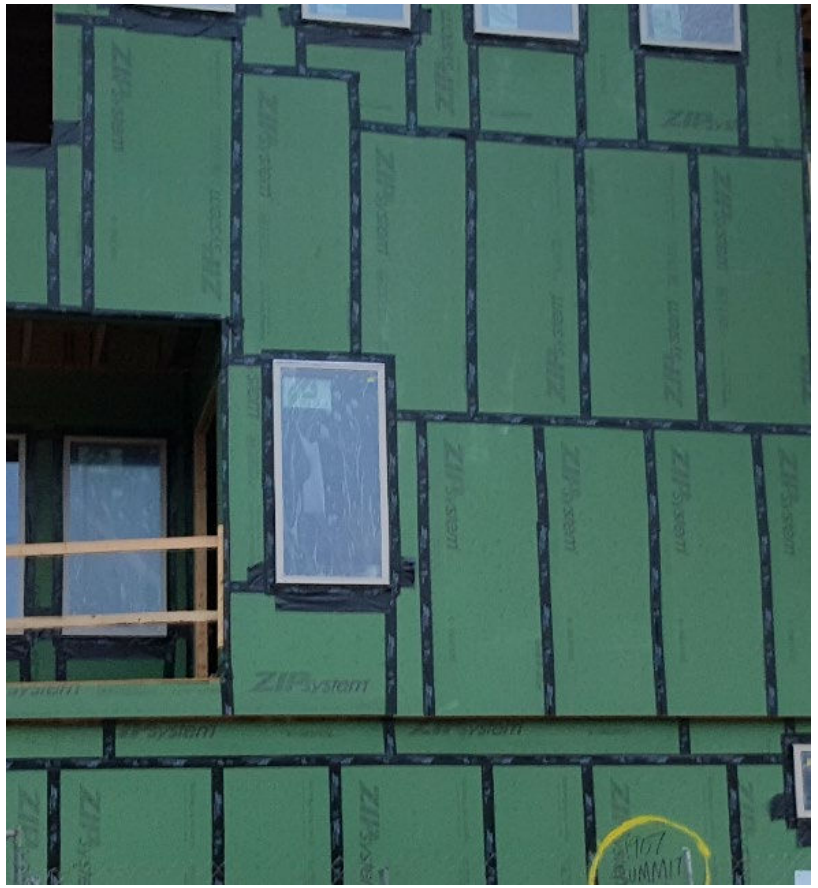
Passive House Levels of Airtightness!


Mechanically attached House-wrap sandwiched behind exterior rigid insulation


Modular builder experienced in Passive House projects & air-sealing building Step Code projects

# Successful Sealed Sheathing Systems

Rely 100% on Properly Detailed & Adhered Joints



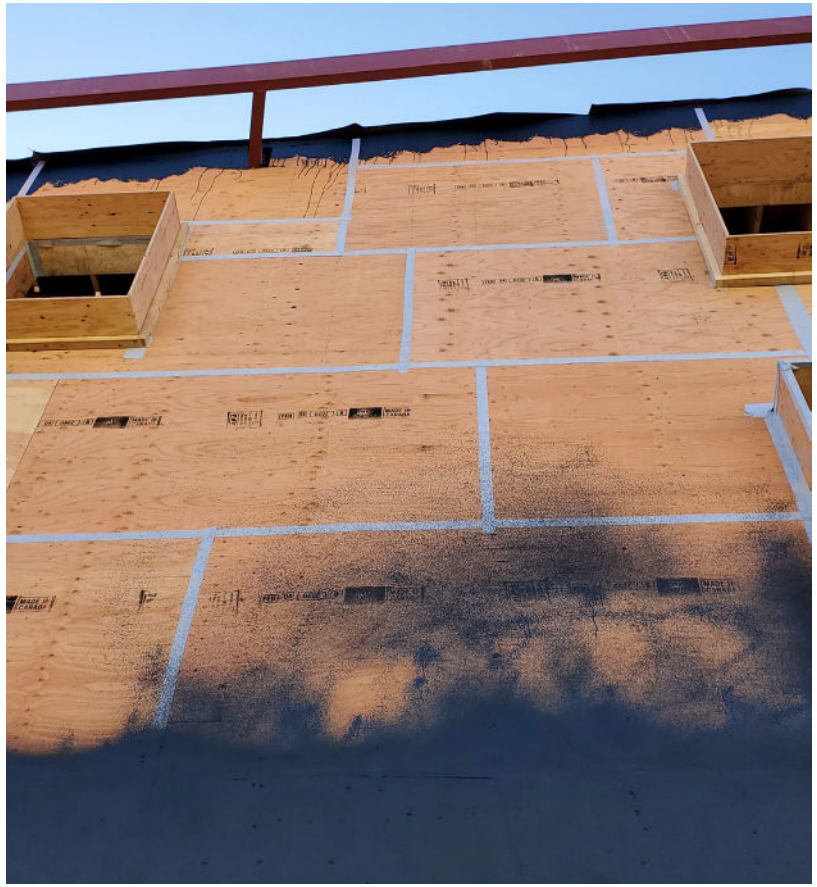

# Self-Adhered Membranes Need to Stick

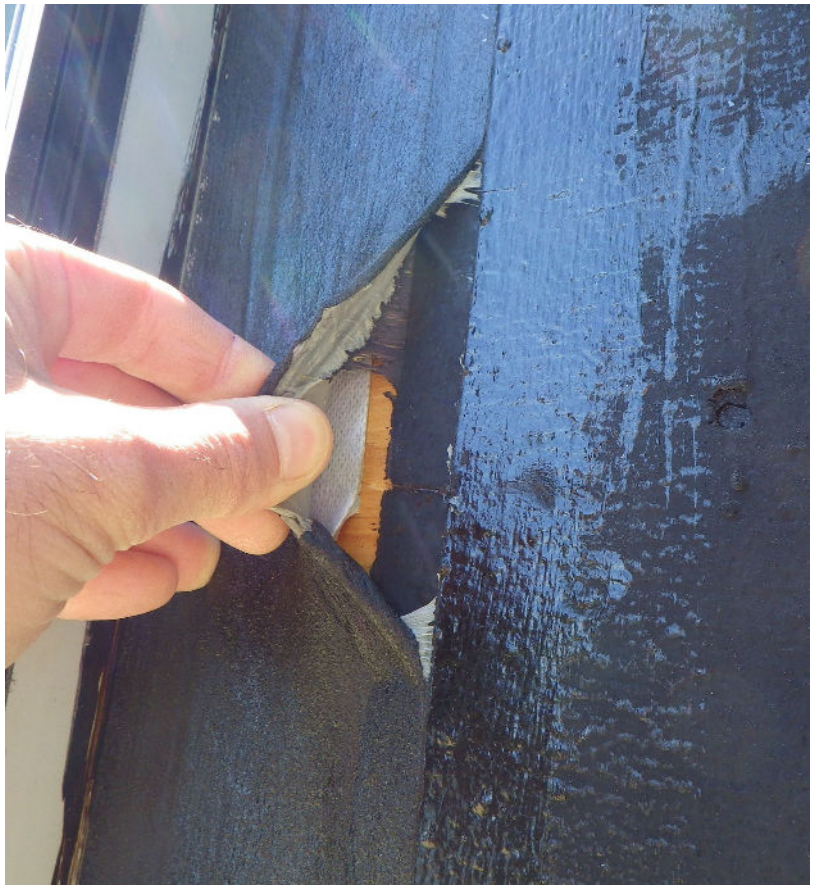
Follow Manufacturer Instructions for Primers & Lap Treatments

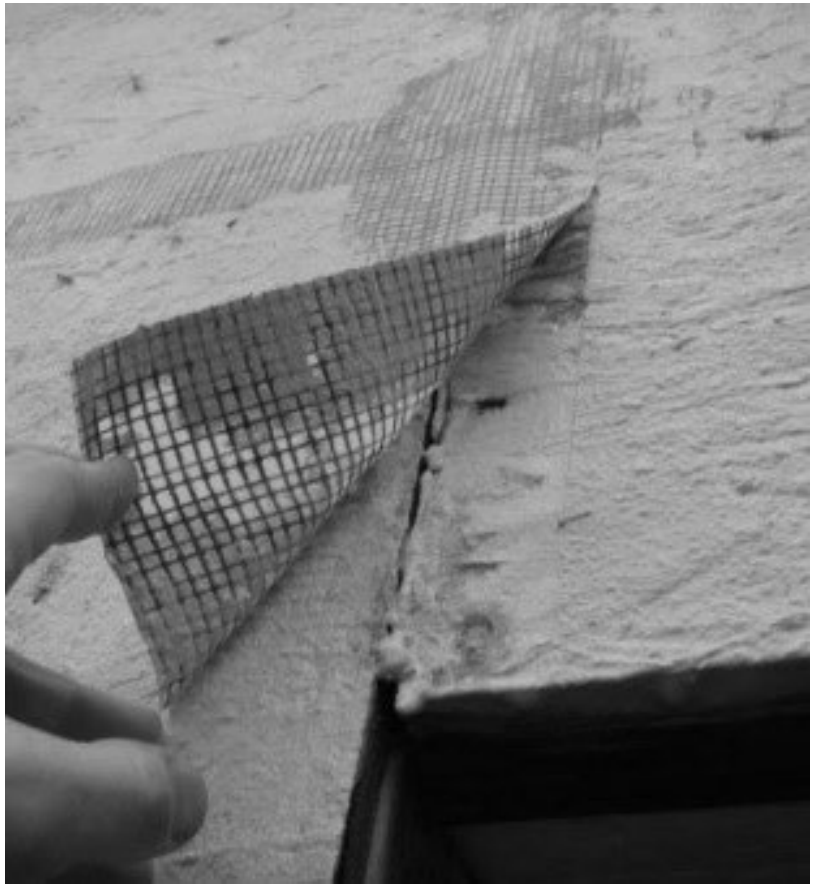
# Self-Adhered Membrane Lap Sealing

# Fluid Applied Systems

Relies on 100% on Preparation, Joint Details & Applicator







# 2 How to Achieve Airtightness

BUILD

# The 3 Keys To Airtight Buildings

## DESIGN

→ Clarity of documents

→ Material selection and assemblies

→ Details and interfaces that are buildable

→ Clear extents of air barrier system (pen test)

→ Design for airtightness

=

**MUST BE CONTINUOUS**

## BUILD

→ Construction sequencing

→ Translating details from design phase into reality

→ Mock-ups

→ Accountability/Responsibility

=

Establish the **Air Boss** role

## CONFIRM

# Construction Schedule

MILESTONES

→ Contractor & trades training

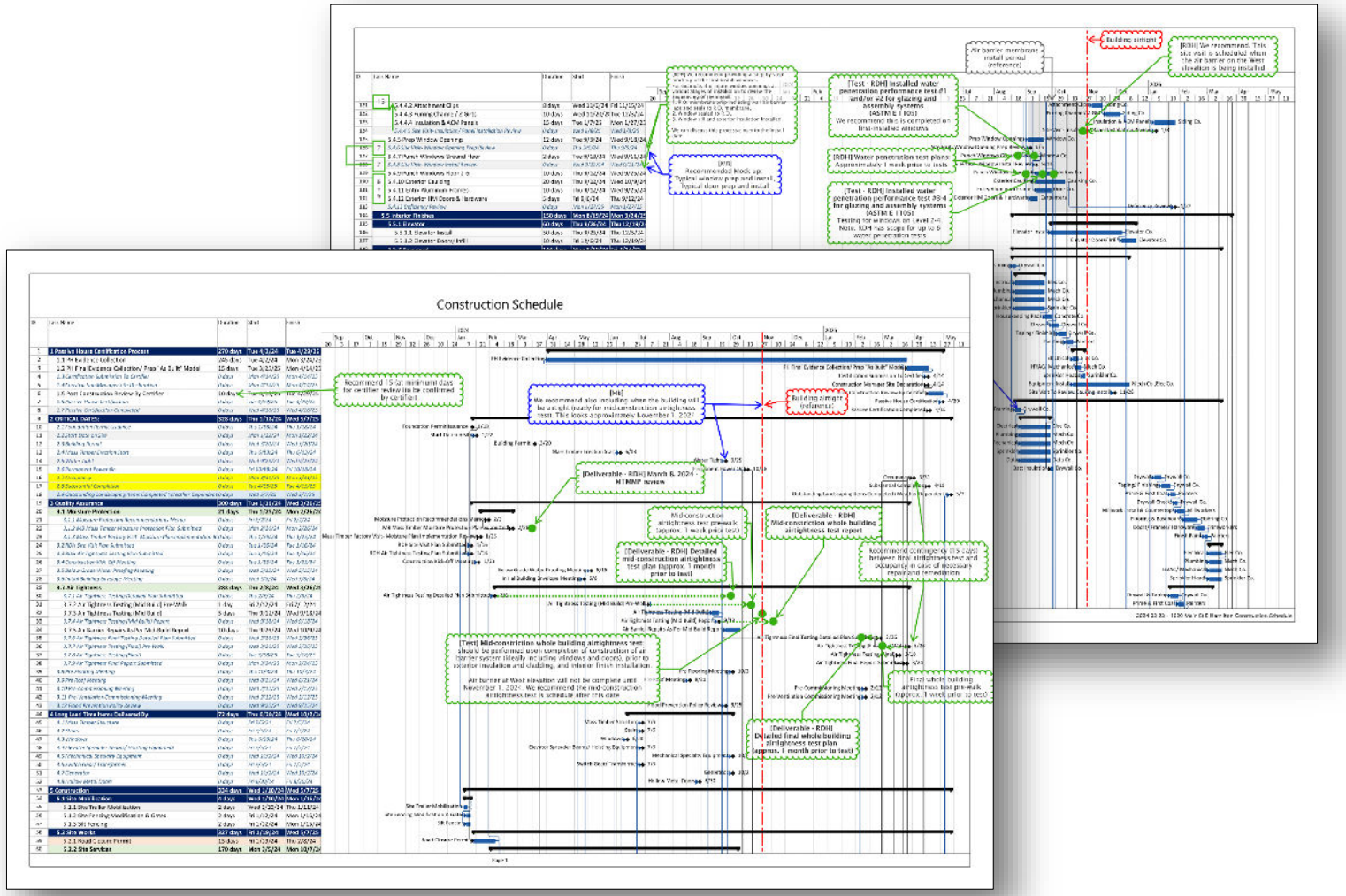
→ Field reviews

→ Mock-up review & testing

→ Mid-construction airtightness testing

→ Final compliance airtightness test

- **Communication is key!**



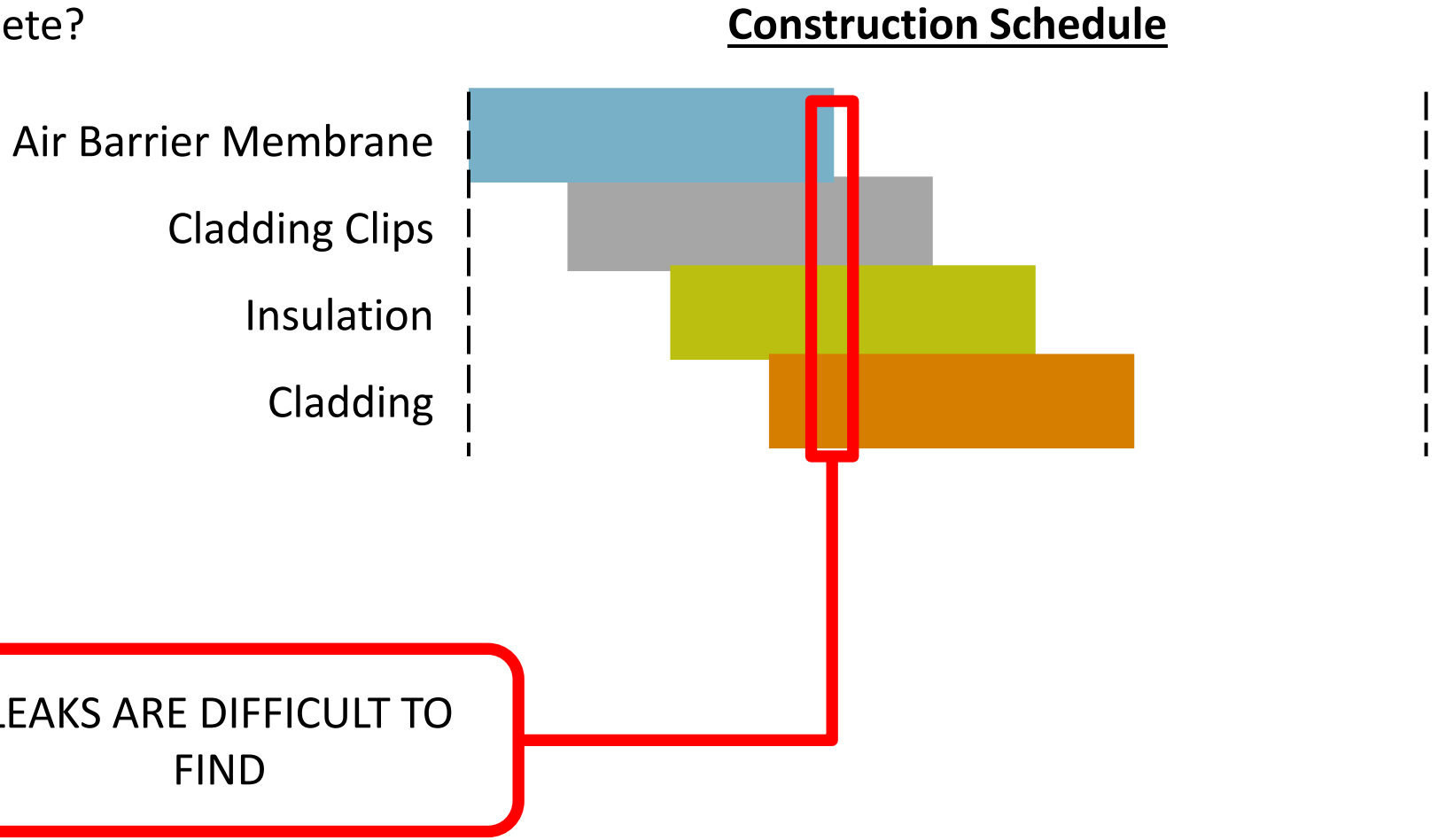
# Construction Schedule

RISK ASSESSMENT

→ When will the air barrier be complete?

→ What type of testing?

- → Whole building testing
- → Floor-based testing
- → Suite-based testing



# Construction Schedule

RISK ASSESSMENT

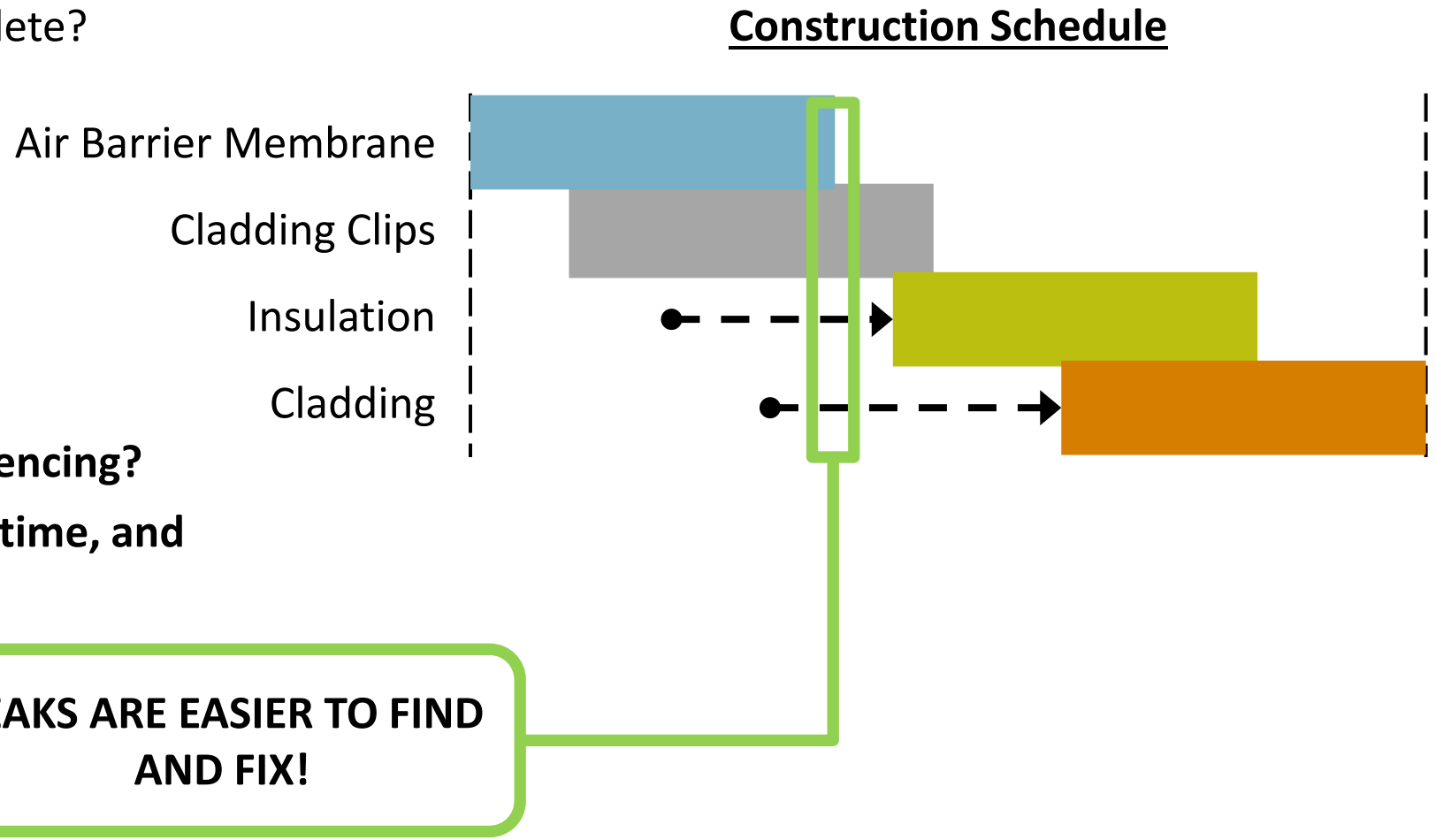
→ When will the air barrier be complete?

→ What type of testing?

- → Whole building testing
- → Floor-based testing
- → Suite-based testing

→ **How flexible is construction sequencing?**

→ **Include building prep, actual test time, and repair time**



# Types of Airtightness Testing

Whole-building Testing

Floor-based Testing

Suite-based Testing

**Increased Risk**

# Types of Airtightness Testing – Special cases

# Challenges with Construction Sequencing

LEAK IDENTIFICATION

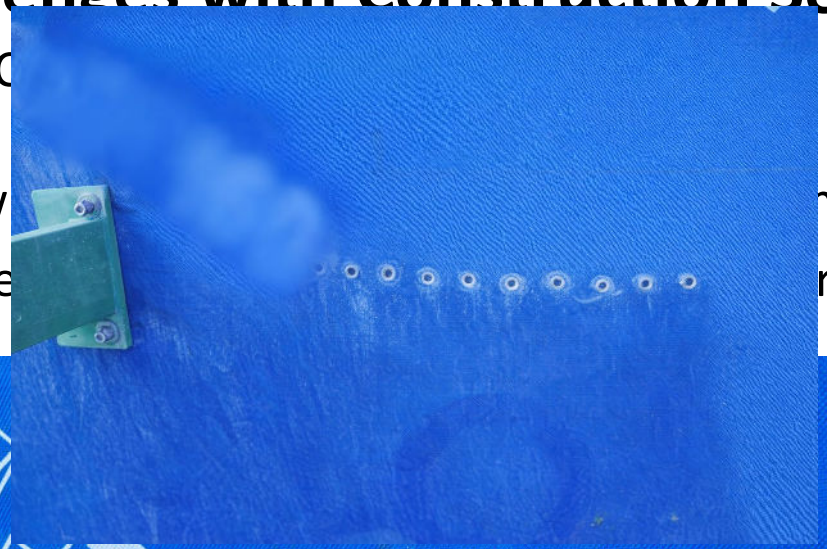
→Complete testing when the air barrier system is complete, but still accessible to make repairs

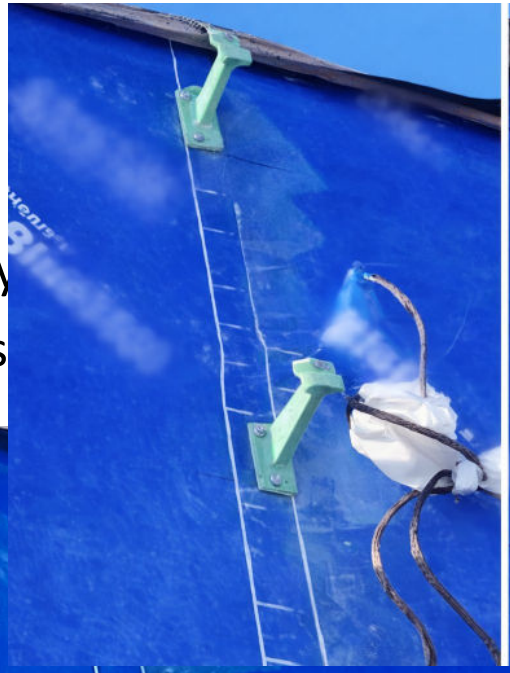

# Challenges with Construction Sequencing

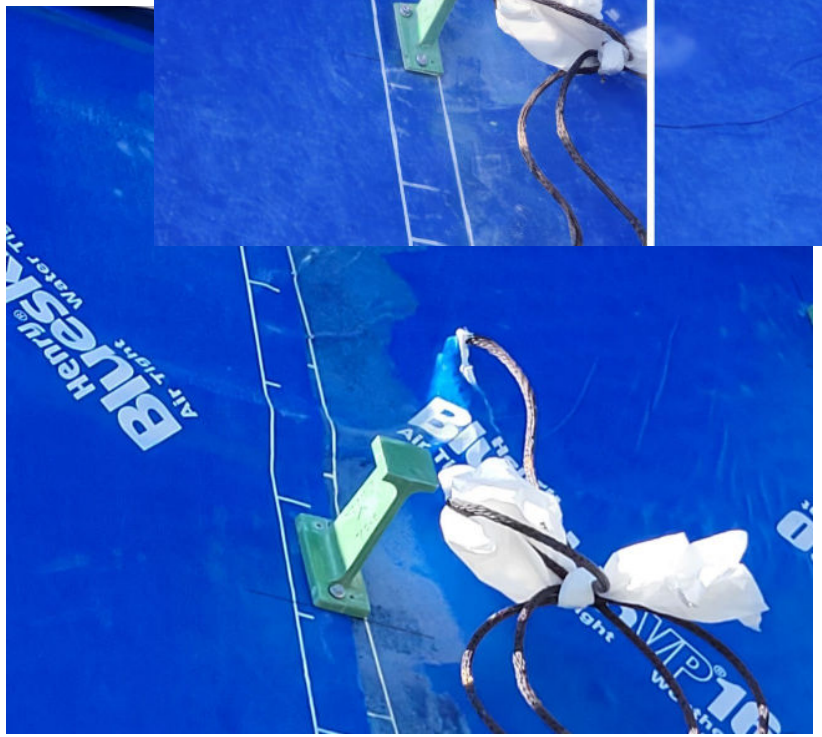
CREW C

→Crew  n trade partway

→Trade  rtight buildings






# Mock-Ups

TRANSLATING DESIGN DETAILING INTO REALITY

→Check sequencing

→Co

→Fin

→Ag

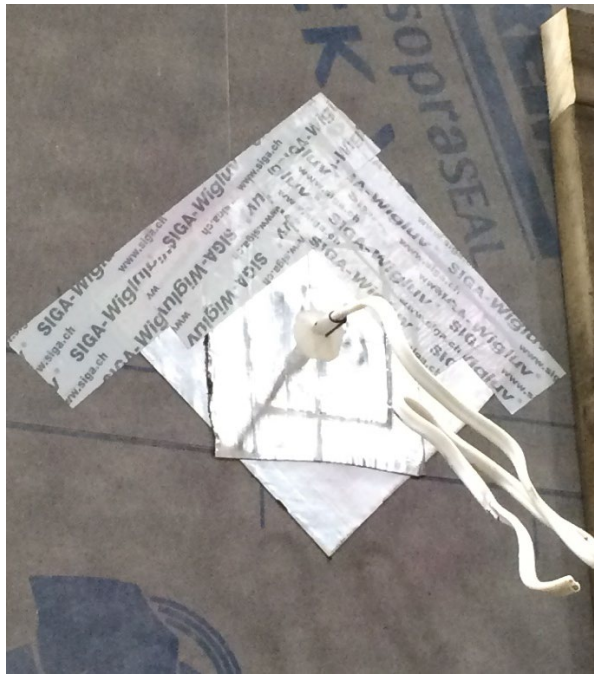
**Go**

# Mock-Ups

→Trades training

→Get buy in from the trades

→Help communicate the design intent.



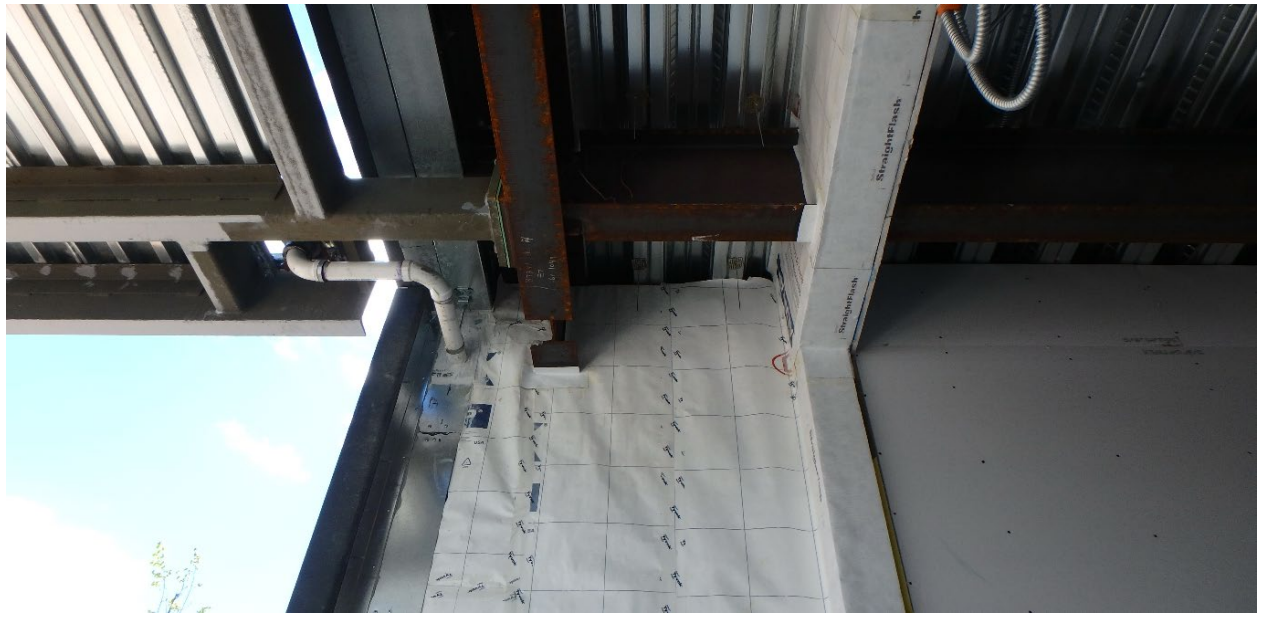

# Build

HOW TO BUILD AIRTIGHT

**Buildable Details**

→Mock-ups Essential

→Not always the details you have – but the ones you don't

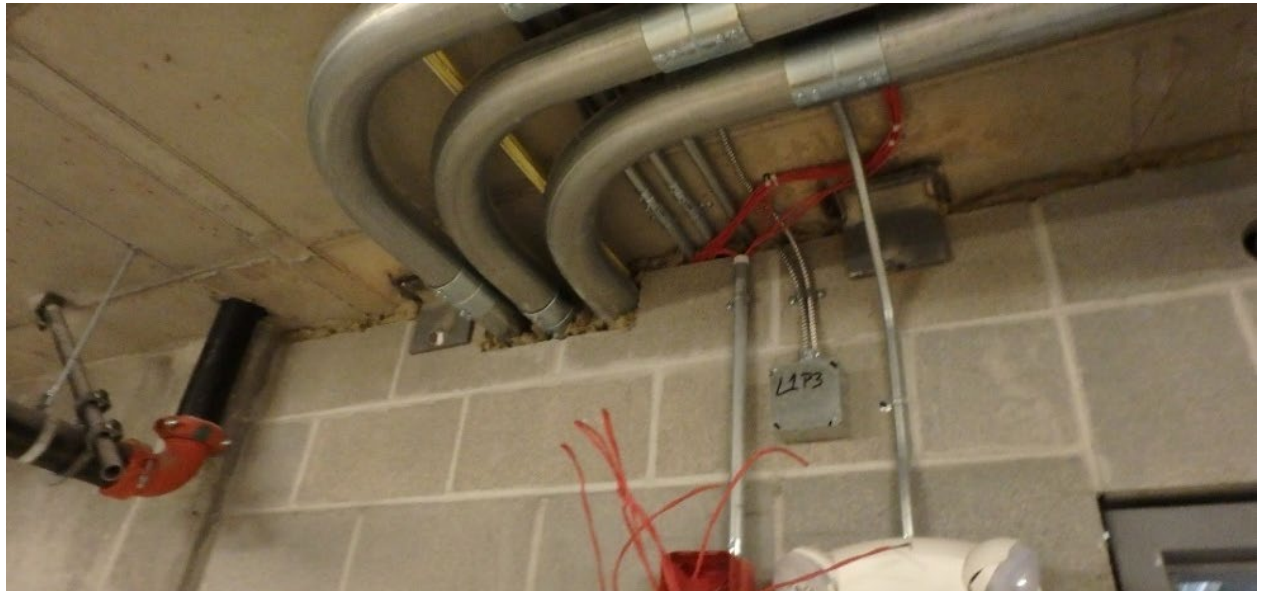


**Sequencing of Materials & Various Trades**

→Workable materials to the conditions (wet, cold, dry, etc.)

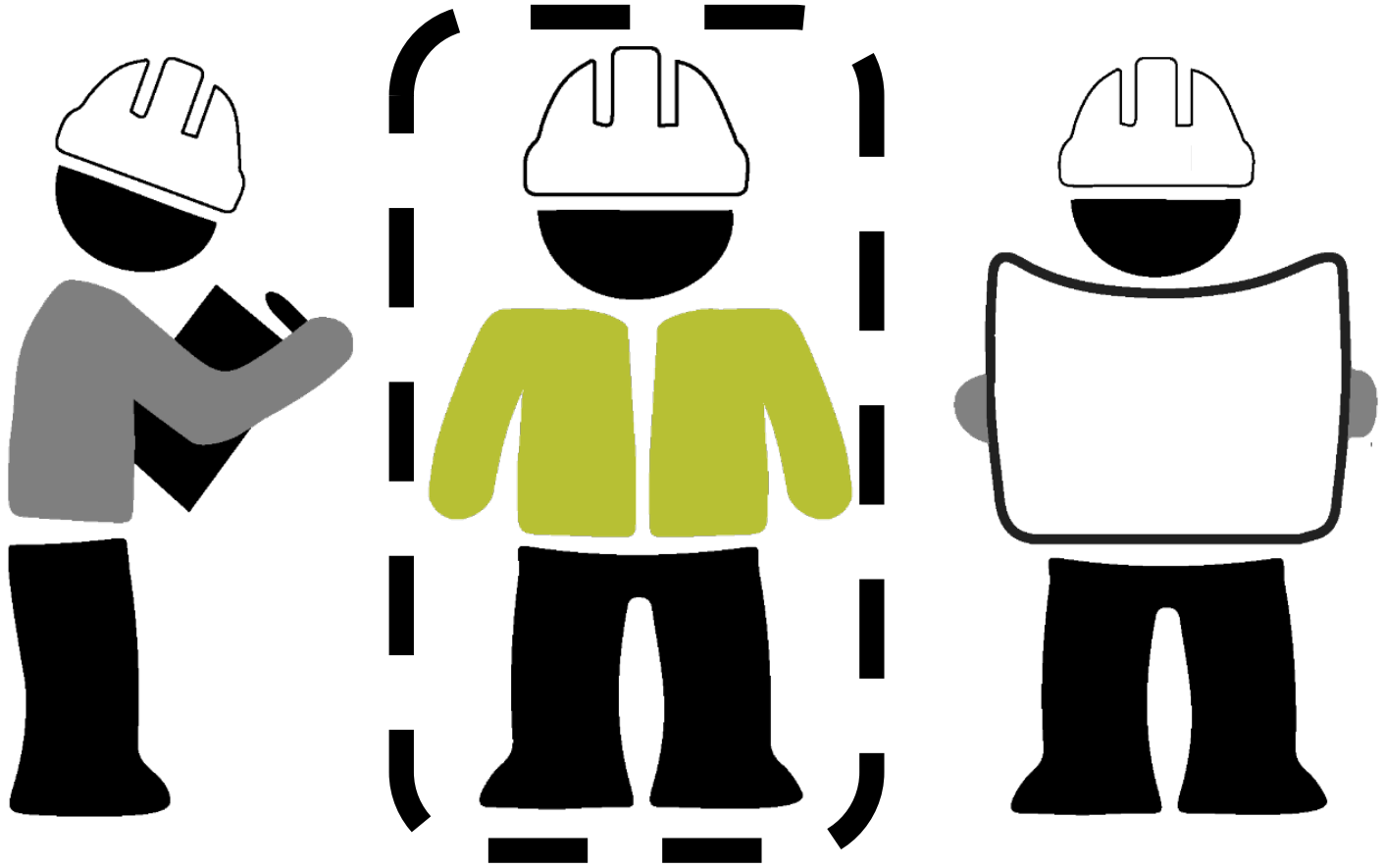
→Compatible Materials (part of design, bid, changes?)

→Accountability – Air Boss



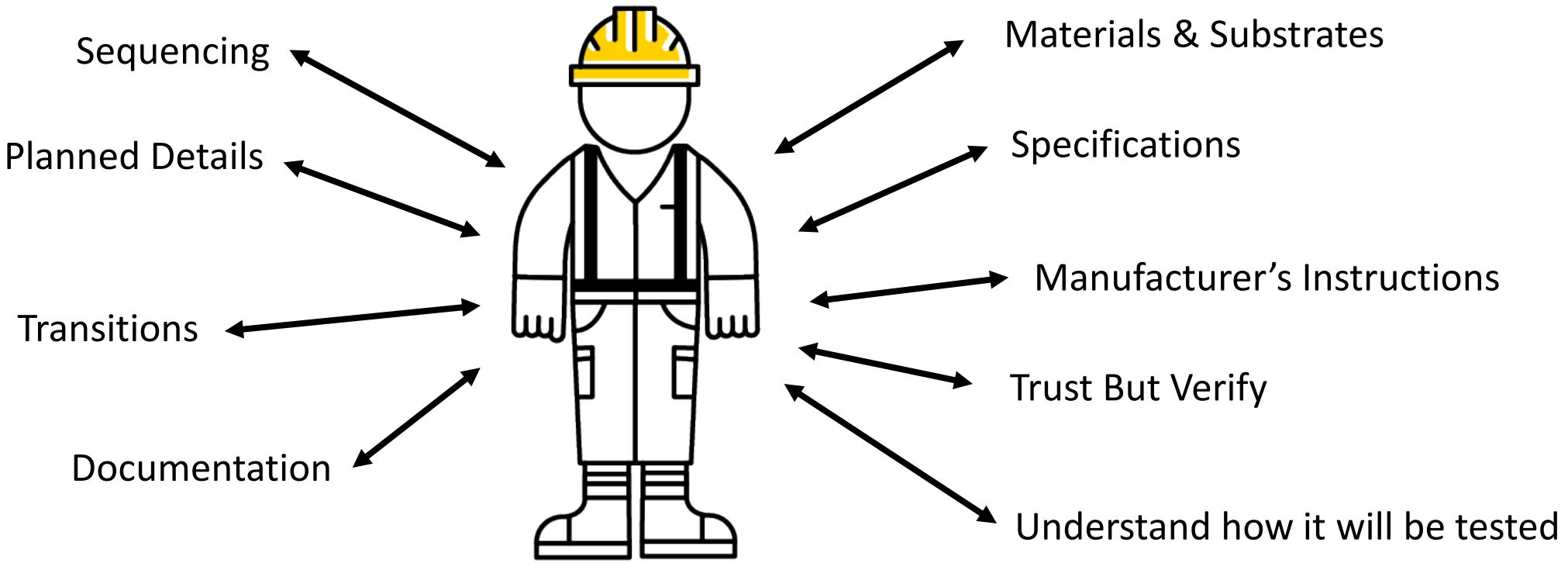
# The Air Boss

SPECIFIC PERSON(S) RESPONSIBLE FOR AIR BARRIER QA/QC & COORDINATION WITH ALL TRADES



# Build

AIR BARRIER SUPERVISOR



3

# How to Achieve Airtightness

CONFIRM

# The 3 Keys To Airtight Buildings

## DESIGN

→ Clarity of documents

→ Material selection and assemblies

→ Details and interfaces that are buildable

→ Clear extents of air barrier system (pen test)

→ Design for airtightness

=

**MUST BE CONTINUOUS**

## BUILD

→ Construction sequencing

→ Translating details from design phase into reality

→ Mock-ups

→ Accountability/Responsibility

=

- Establish the **Air Boss** role

## CONFIRM

→ Visual Field Review: contractor QA/QC, 3rd party review, & commissioning

→ Qualitative testing: water, smoke, infrared, etc.

→ Quantitative testing: measured air leakage

→ Risk management:

- **Aim for better than target?**

# Visual Review – Contractors QA/QC and 3rd Party


# Mock-up Testing

Reducing Risk on the project!


# Air Leakage Detection

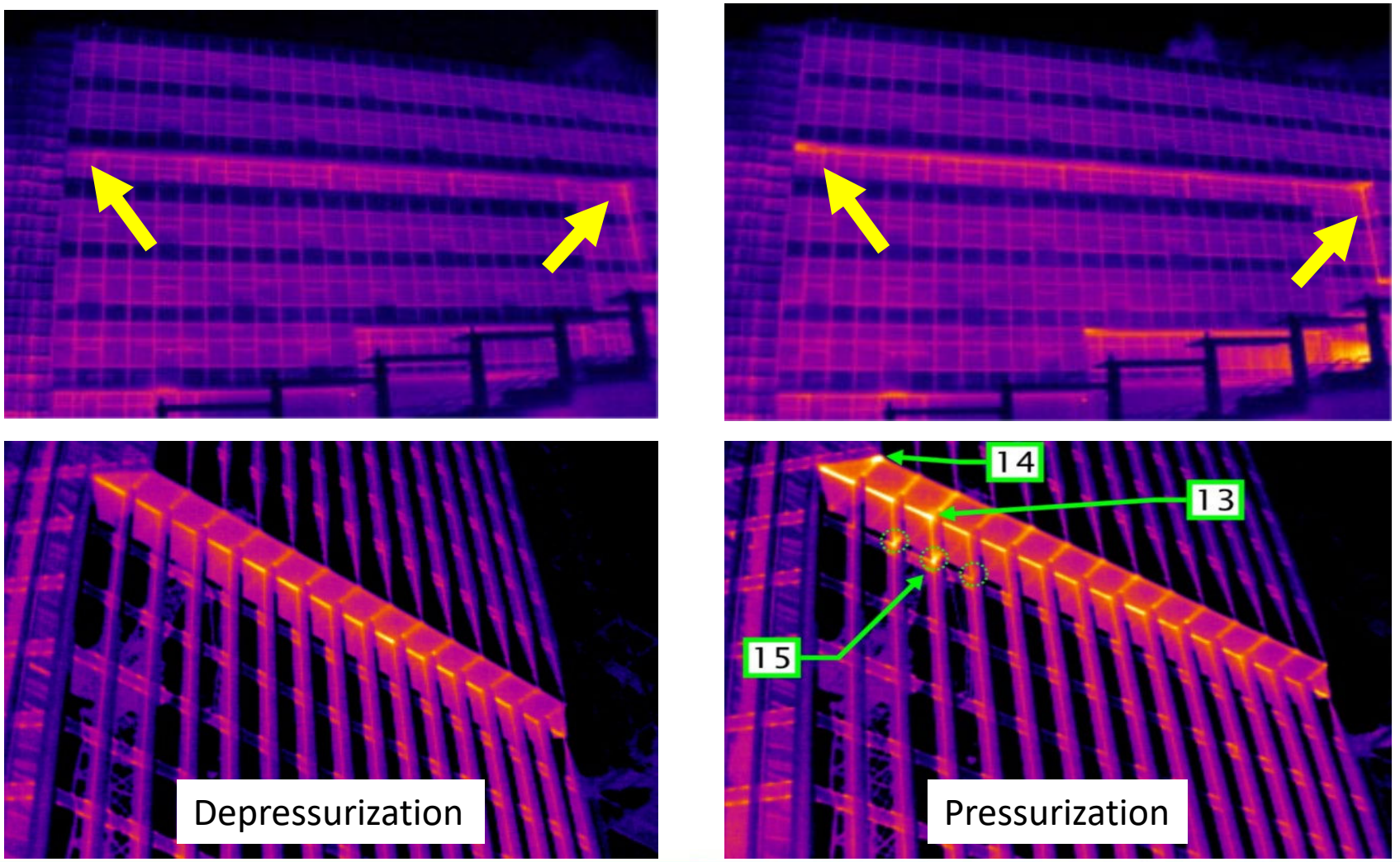
ASTM E1186 - AIR LEAKAGE SITE DETECTION - SMOKE

→Theatrical fog (smoke)

→Usually immediate, obvious, and repeatable.

# Air Leakage Detection

ASTM E1186 - AIR LEAKAGE SITE DETECTION – INFRARED THERMOGRAPHY



# CONFIRM

HOW TO CONFIRM?

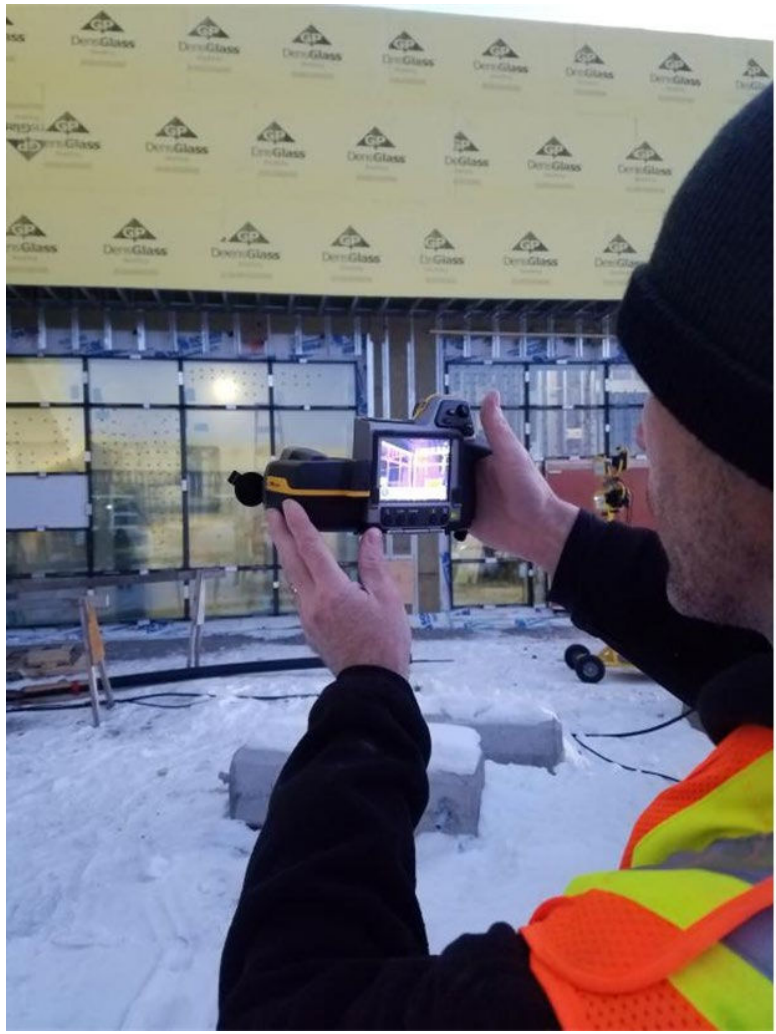
Commissioning of the Air Barrier System

→Visual review

→Contractor's QA/QC & 3rd Party Reviews

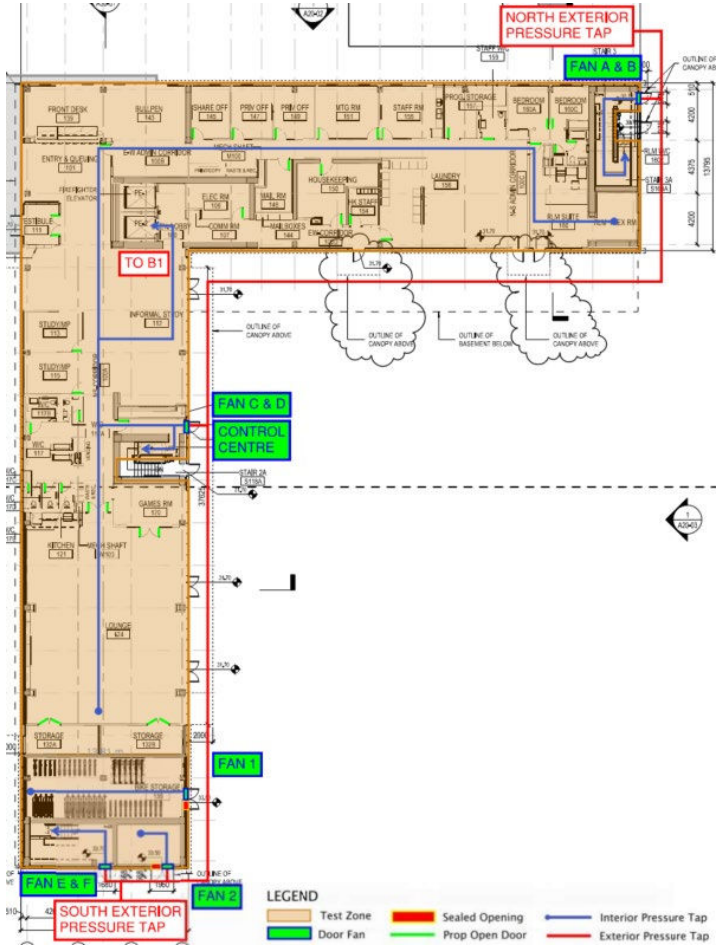
→Qualitative Testing

→Quantitative Testing – Target number

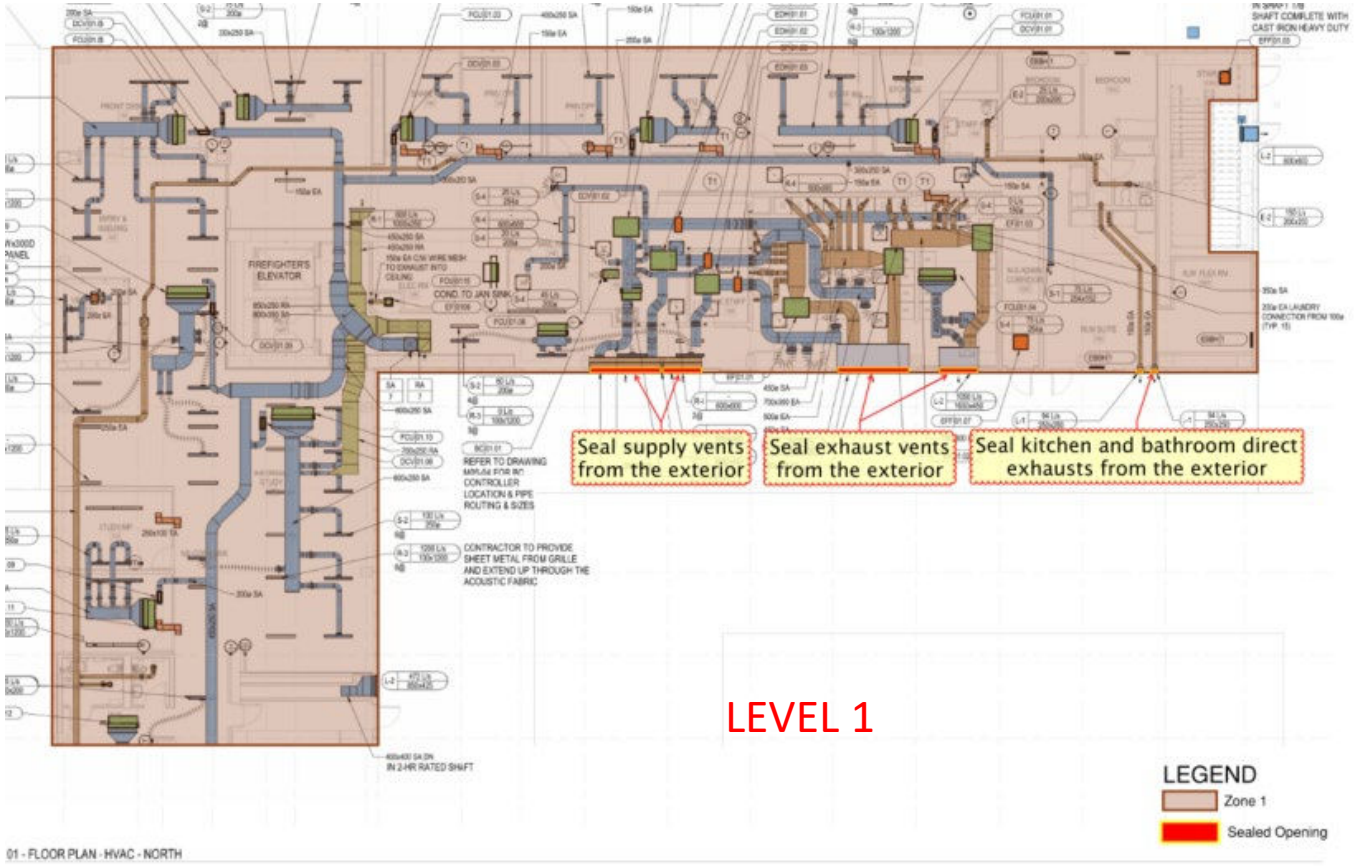


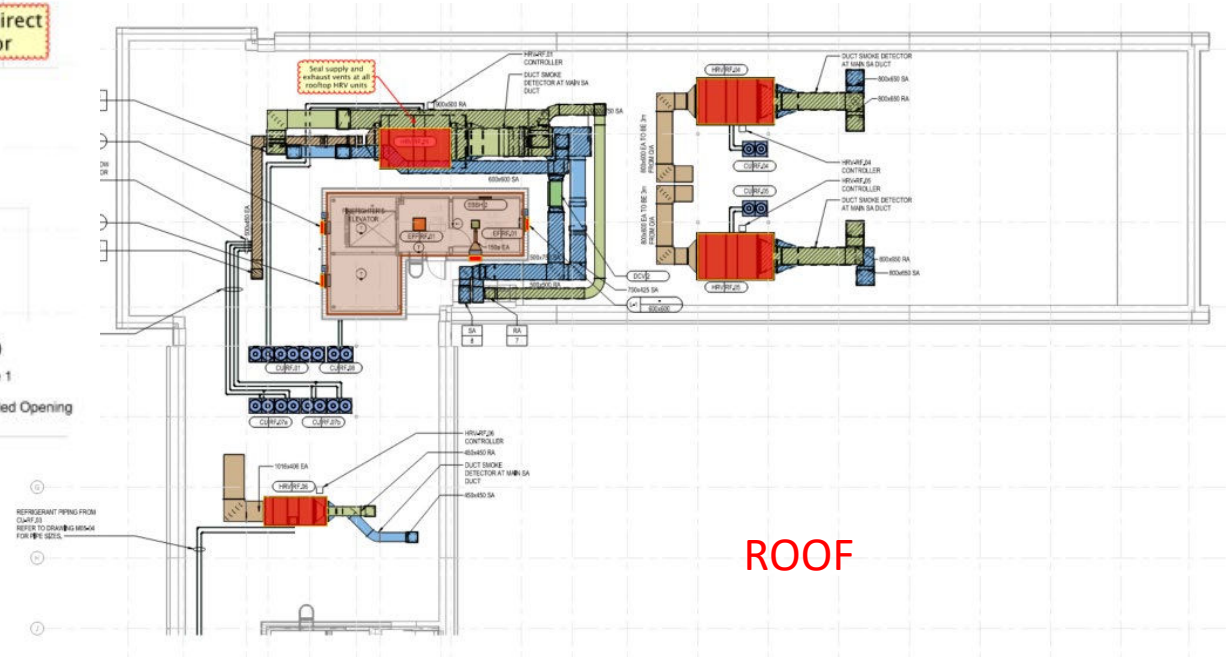
# CONFIRM

## QUANTITATIVE TESTING AS A FINAL TARGET TO MEASURE PERFORMANCE

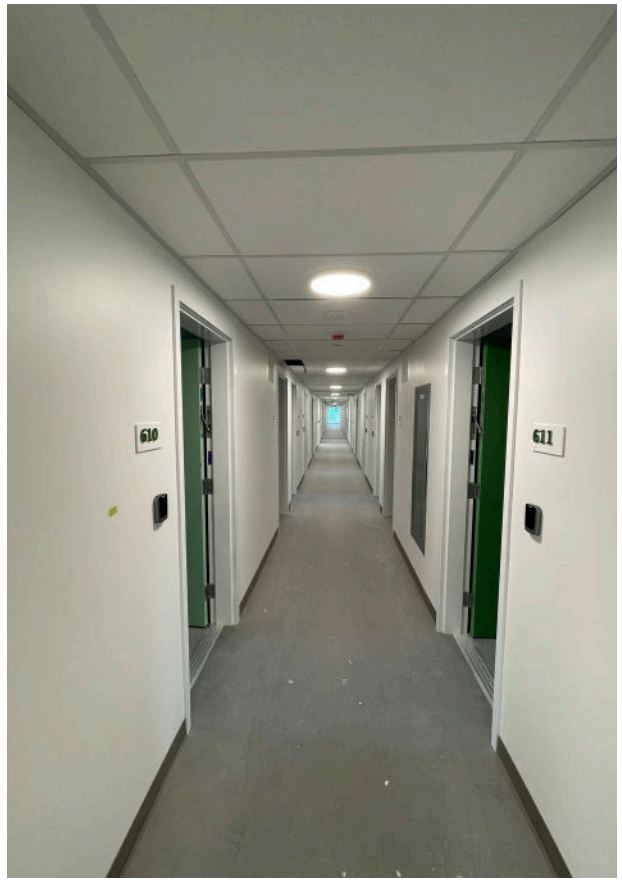



# CONFIRM


Seal supply vents from the exterior
Seal exhaust vents from the exterior
Seal kitchen and bathroom direct exhausts from the exterior
LEVEL 1
LEGEND
Zone 1
Sealed Opening
01 - FLOOR PLAN - HVAC - NORTH


ROOF

# CONFIRM




Interior doors propped open.

Kitchen exhaust sealed.

Air Handing units sealed.

Exhaust fans sealed.

# CONFIRM

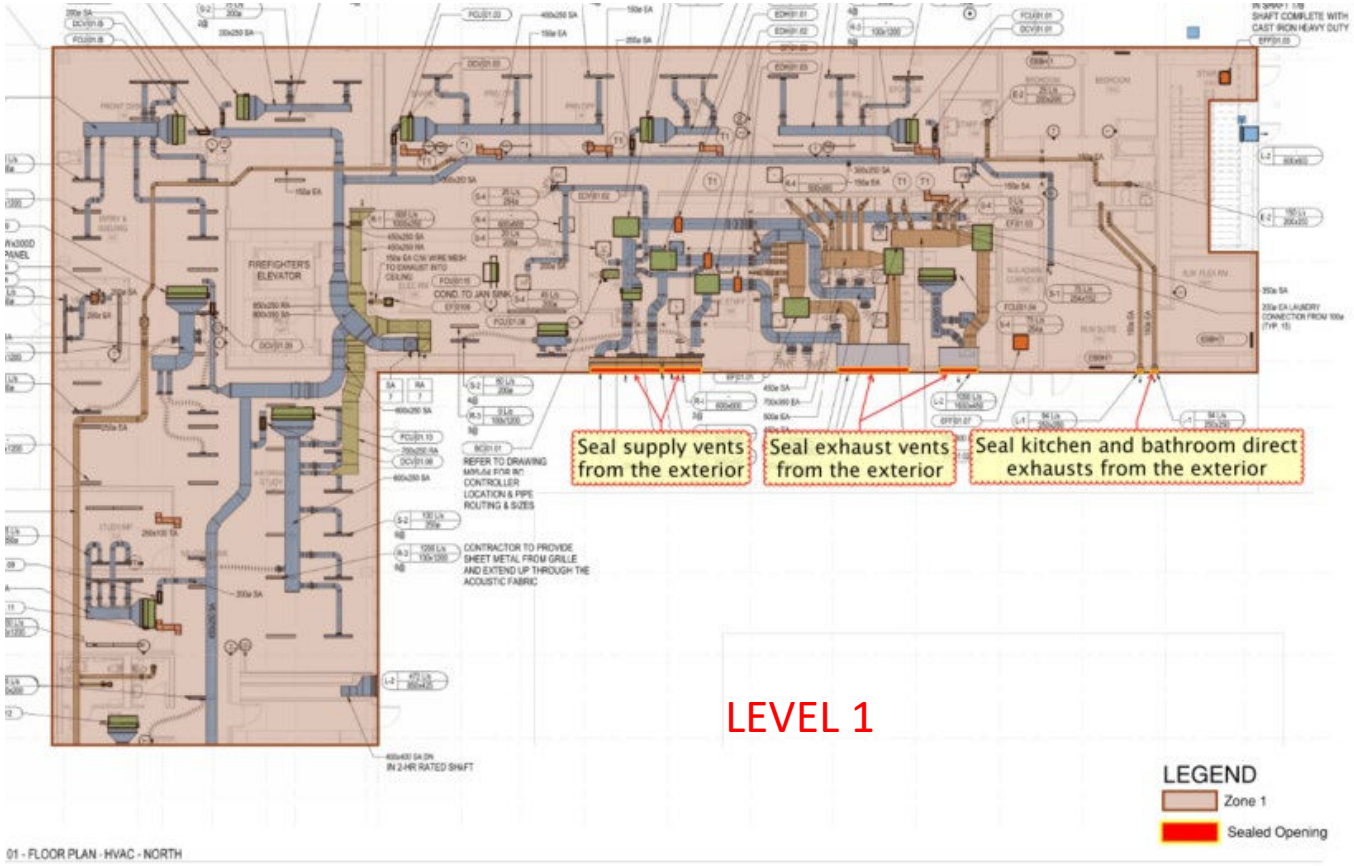

Elevator overrun roof door masked shut due to missing door hardware and gasket.

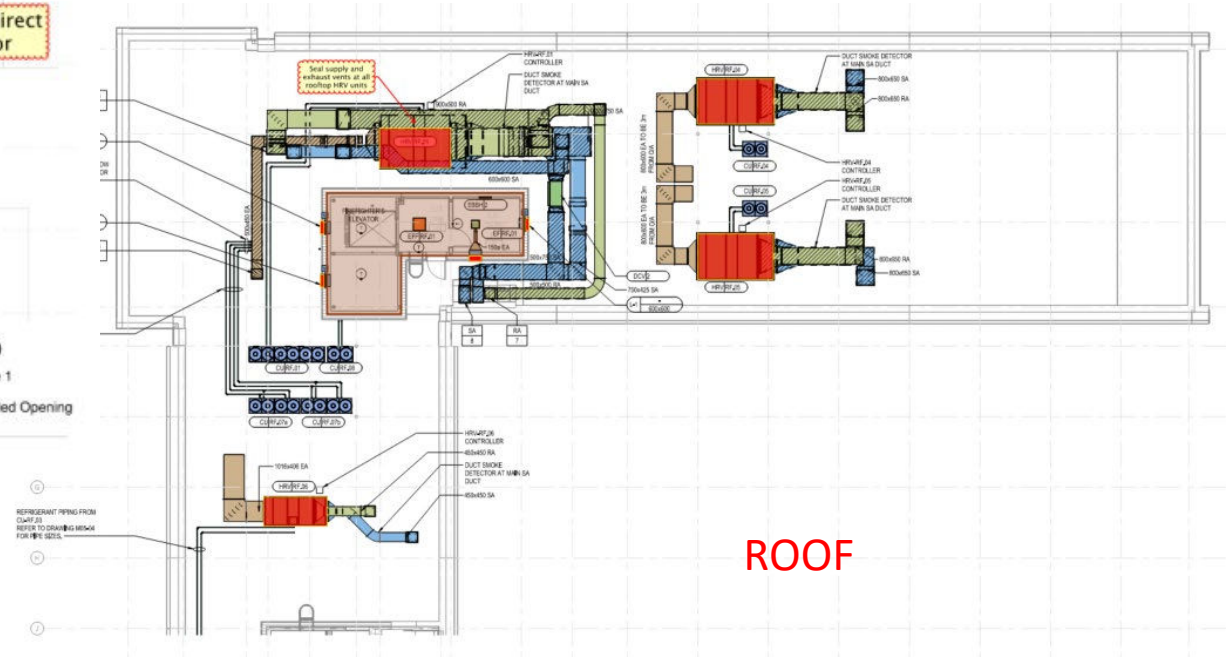
Elevator overrun exhaust masked shut from outside, done last to prevent overheating.

Unit 246 window masked shut due to hardware not latching.


Pressure sensors to B106B and 1301 sent through elevator shaft.

# CONFIRM


Seal supply vents from the exterior
Seal exhaust vents from the exterior
Seal kitchen and bathroom direct exhausts from the exterior
LEVEL 1
LEGEND
Zone 1
Sealed Opening
01 - FLOOR PLAN - HVAC - NORTH


ROOF

# Results of Quantitative Testing

→ Did the project meet the test target?

→ Test results.

→ Test method; did it deviate from the test plan? If so, why?

→ Enclosure area takeoffs and calculations

→ Test apparatus.

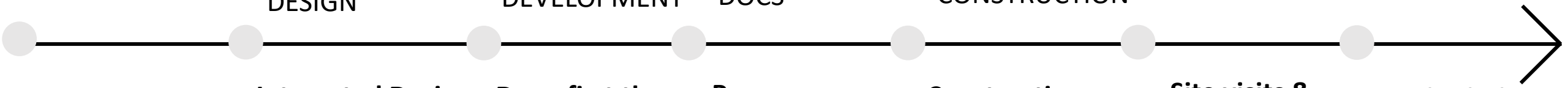
→ All test recorded test data.

→ Normalization method if applicable. (for pressure equalized/guarded tests)

# ALL 3 MUST BE PRESENT !

1. DESIGN
2. BUILD
3. CONFIRM

# Airtightness at Every Stage of Delivery



| PRE DESIGN | SCHEMATIC DESIGN | DESIGN DEVELOPMENT | CONSTRUCTION DOCS | PRE CONSTRUCTION | CONSTRUCTION | OCCUPANCY |
|---|---|---|---|---|---|---|
| **Owner's Project Requirements** | **Integrated Design Charette** | **Draw first the details that matter most** | **Prepare specifications** | **Construction kickoff** | **Site visits & testing** | **Final Whole Building Test** |
| Set appropriate targets and objectives.<br><br>Establish a protocol for evaluating the target. | 1st energy model sets targets (Include 20% buffer)<br><br>Identify air barrier boundaries and select suitable Air Barrier strategy | Ensure the air barrier is clearly identified on all details<br><br>Include a dedicated drawing to identifying the air boundary | Prepare an air barrier testing specifications<br><br>Establish the responsibilities of the Air Barrier supervisor | Identify the air barrier supervisor<br><br>Construction mock-ups, train site workers<br><br>Comprehensive QA/QC plans | Daily Walkthroughs<br><br>Identify when and where to conduct mid-construction testing<br><br>Enclosure reviews | Debrief on lessons learned |

# THANK YOU!

**Sherman Wai | M.Eng., P.Eng., CPHD., PHI Building Certifier**

**E: swai@rdh.com**
**O: 778-370-6952**

abaa building enclosure conference


abaa 2026
building
enclosure
conference