air barrier abaa association of america

BUILDING ENCLOSURE CONFERENCE

RESTON VA

2022

MAY 10-11

Roof-to-Wall Connections:

The Big Disconnect

Roy F. Schauffele, FCSI, CCPR, FABAA, CABS

Division 7 Solutions, Inc.

abaa EDUCATION

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Course Description

As more states, jurisdictions and the design community require air barriers, the issue of connecting the wall air barrier assembly to other building assemblies, such as below grade, window systems and roofs need to be completely understood in order to design and construct a functioning building enclosure.

One of the most often missed or not well executed details is the connection between the wall air barrier and roof assembly. With a myriad of roof systems, wall configurations and the growing number of wall air barrier products, it can be difficult to navigate the process in regards to what systems work best with each other and the chemical compatibility of these systems.

This presentation will focus on things to consider from a design standpoint, along with practical approaches to ensuring a robust connection is constructed and executed.

Learning Objectives

1. Become aware of compatibility issues between the roof and wall
2. Understand the importance of the roof/wall air barrier
3. Understand the integration of the different types of air barriers into the roof assembly
4. Learn the basic requirements for detailing and sequencing of roof/wall connections


W^ABAA

Quick Math: # of Products

3 types of back up walls

- Block, OSB, exterior sheathing

5 types of air barriers

- Fluid, self-adhered, SPF, board stock, mechanically fastened

4 types of insulation

- SPF, EPS, polyiso, mineral wool

4 types of cladding

- Brick, metal panel, EIFS, cement board

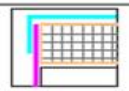
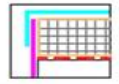
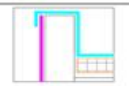
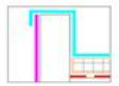
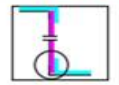
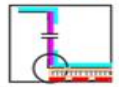
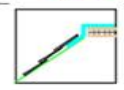
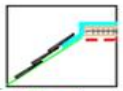
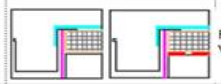
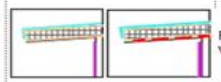
Total

- **116 wall configurations**

More Quick Math: # of Manufacturers

ROOF TIE-IN TO WALL BARRIERS

LAST Updated: August 22, 2018 4:00 pm

		LOW SLOPE ROOF													STEEP SLOPE ROOF		
		EPDM/TPO	PVC/KEE	PROTECTED MEMBRANE ROOF (IRMA)	GREEN ROOF	BUR HOT ASPHALT	BUR COLD PROCESS	LIQUID-APPLIED (PMMA)	BUR COAL TAR	MODIFIED ASPHALT APP/SBS/SEBS/SIS	POLYURETHANE FOAM ROOF	MISC. (INSULATED STRUCTURAL PANELS, SKYLIGHTS, ETC)	METAL (COPPER) FLAT ROOF	PRESSURE-EQUALIZED ROOFS	SHINGLES (ALL TYPE)	METAL (ARCHITECTURAL STANDING SEAM)	METAL (STRUCTURAL STANDING SEAM)
ABBA DETAILS TO BE DEVELOPED, WHICH ARE MORE CRITICAL →		YES	YES			YES				YES	YES				YES	YES	
ROOF EDGE (GRAVEL STOP TYPE)	 ROOF WITHOUT VAPOR BARRIER																
	 ROOF WITH VAPOR BARRIER																
PARAPET (OPTION 1: PARAPET BUILT BEFORE TIE-IN)	 ROOF WITHOUT VAPOR BARRIER																
	 ROOF WITH VAPOR BARRIER																
PARAPET (OPTION 2: PARAPET BUILT AFTER TIE-IN)	 ROOF WITHOUT VAPOR BARRIER																
	 ROOF WITH VAPOR BARRIER																
LOW ROOF TO UPPER WALL	 ROOF WITHOUT VAPOR BARRIER																
	 ROOF WITH VAPOR BARRIER																
FLAT ROOF TIE-IN TO STEEP SLOPED ROOF	 ROOF WITHOUT VAPOR BARRIER																
	 ROOF WITH VAPOR BARRIER																
THROUGH-WALL SCUPPER	 ROOF WITHOUT VAPOR BARRIER																
	 ROOF WITH VAPOR BARRIER																
ROOF GUTTER EDGE	 ROOF WITH/WITHOUT VAPOR BARRIER																
ROOF OVERHANGS OR CANTILEVERED AT EXTERIOR WALL	 ROOF WITH/WITHOUT VAPOR BARRIER																

BUR (BUILT-UP ROOF MEMBRANES); **IRMA** (INSULATED ROOF MEMBRANE ASSEMBLY); **PMMA** (POLY-METHYL-METHACRYLATE); **PVC** (POLY VINAL CHLORIDE); **SEBS** (STYRENE ETHYLENE BUTADIENE STYRENE); **SIS** (STYRENE-ISOPRENE-STYRENE); **TPO** (THERMOPLASTIC POLYOLEFIN)

What about roof/wall connections?

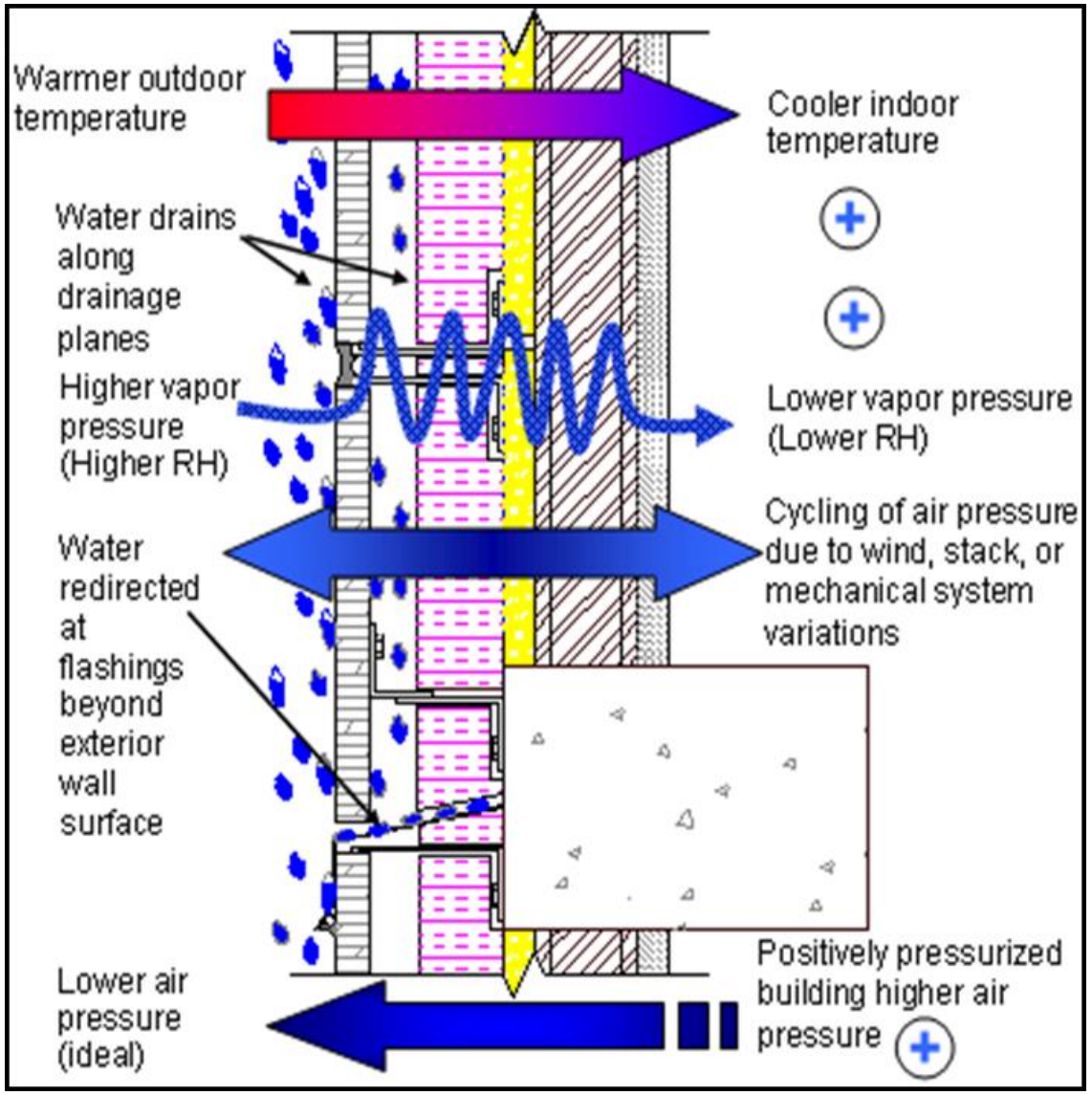
- 16 roof types multiplied # of manufacturers
- 10 air barriers types multiplied # of manufacturers
- X amount of connections?

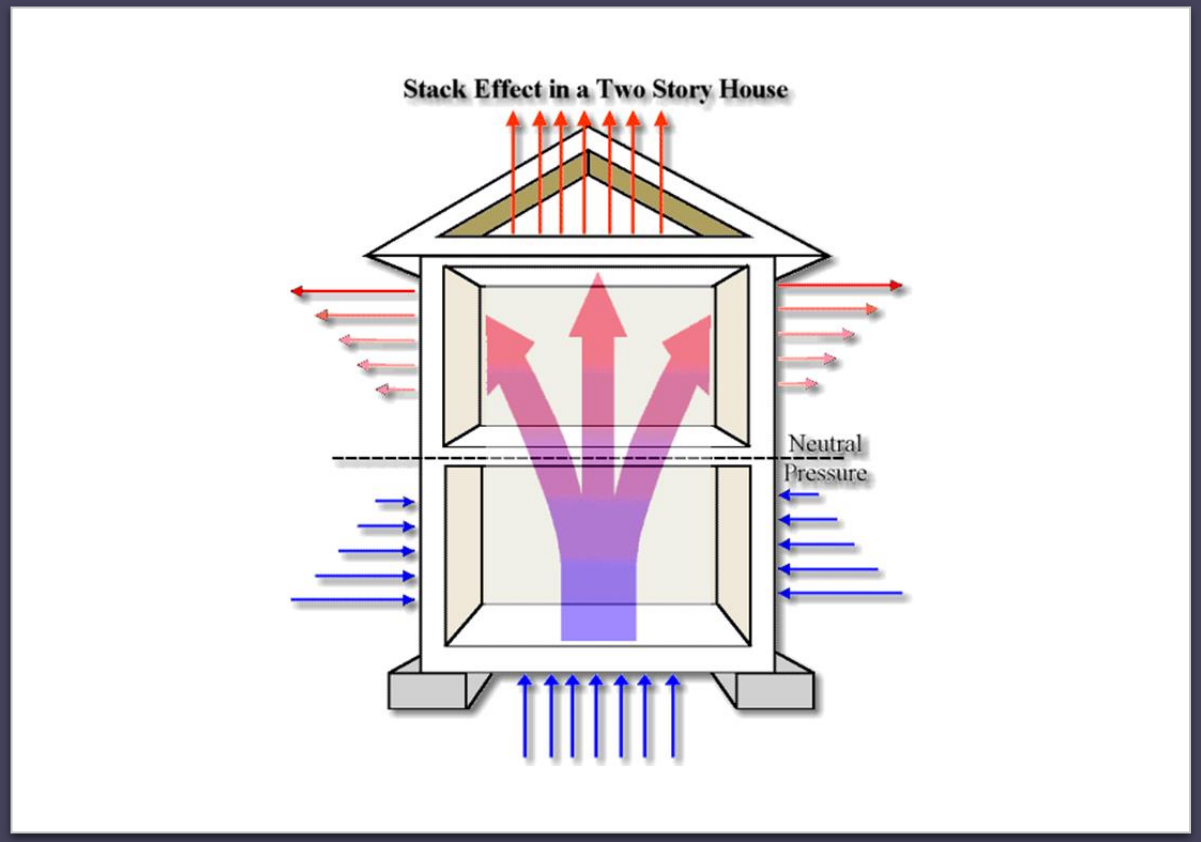
Roof / Wall Connections

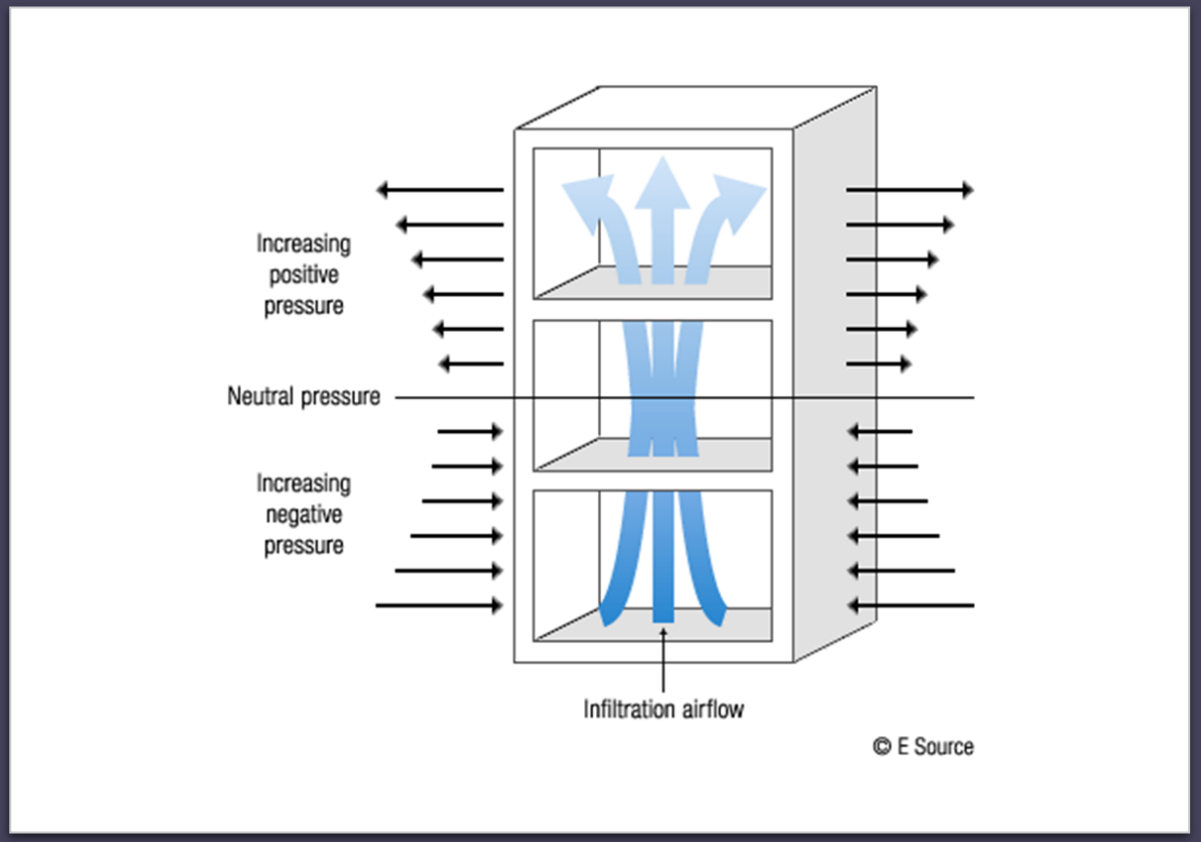
- Why is it so important:
  - Building science
  - Significant area that causes air/water leakage
    - Windows are the #1 area
  - “Largest” holes in the air barrier system

Building Science

- Purpose of the air barrier
  - Reduce air flow
  - Reduce moisture/water





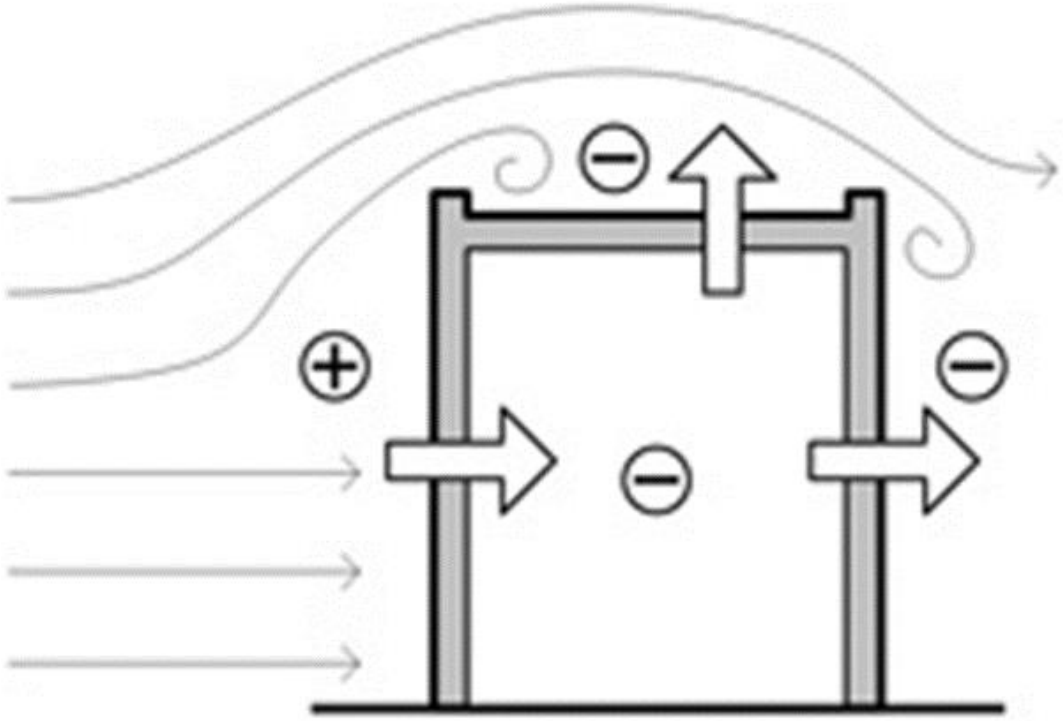


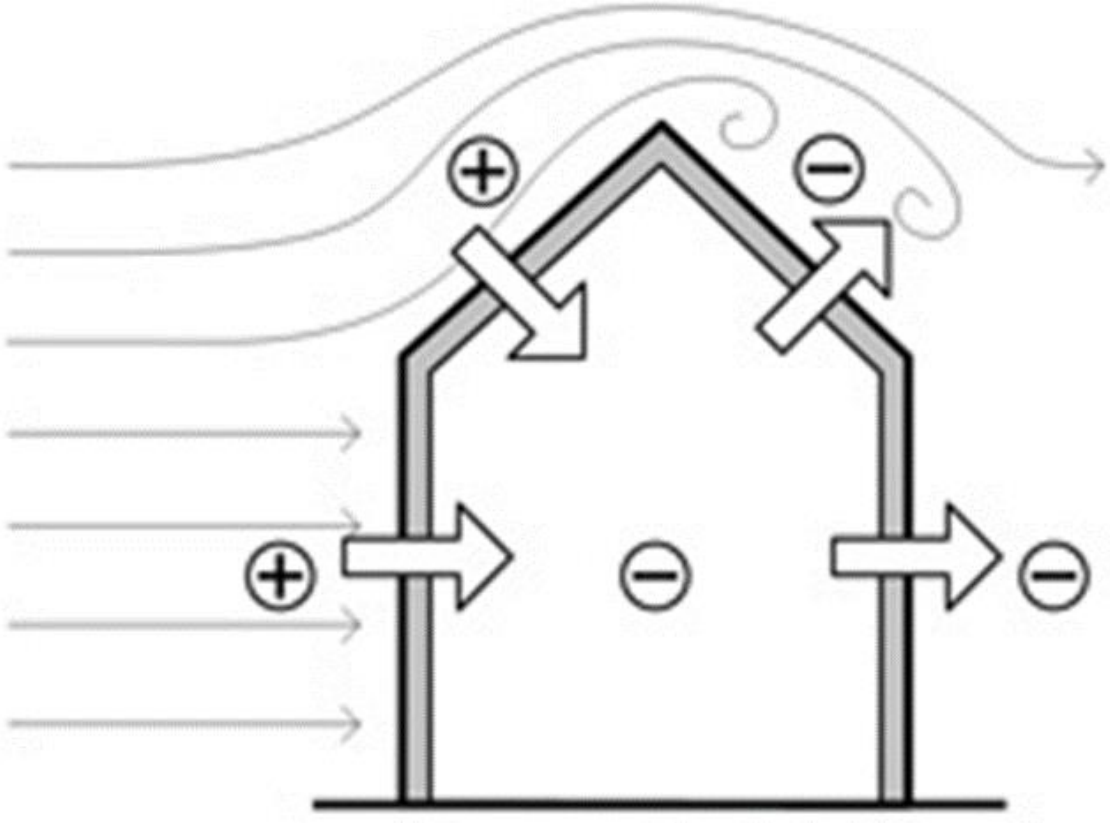
Building Science

Air Flow – Stack Effect

Building Science

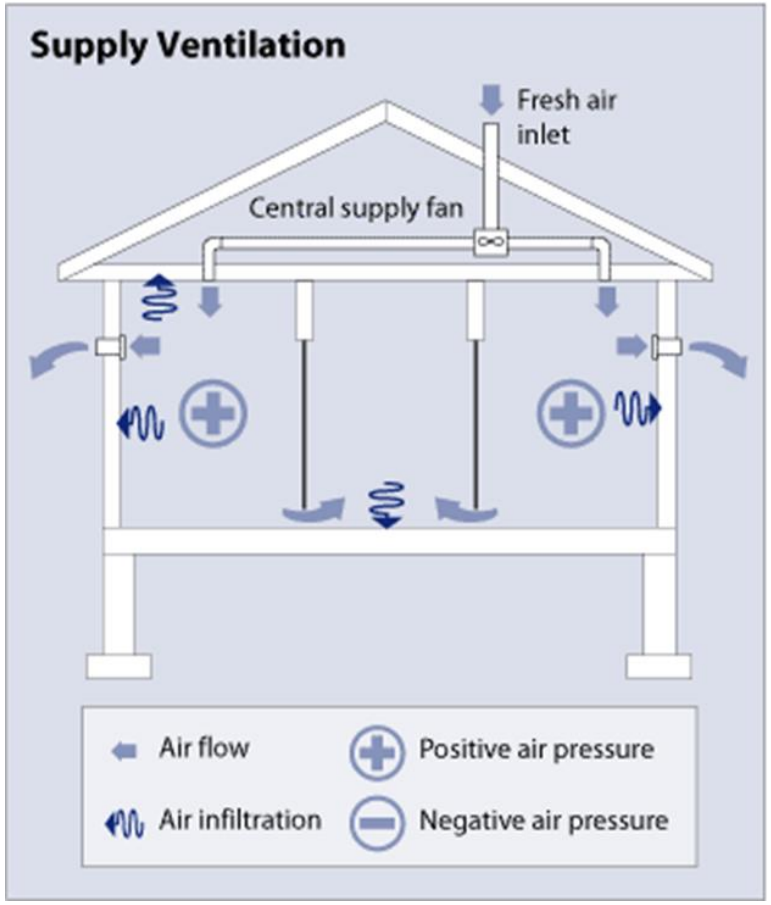
Air Flow – Wind Effect





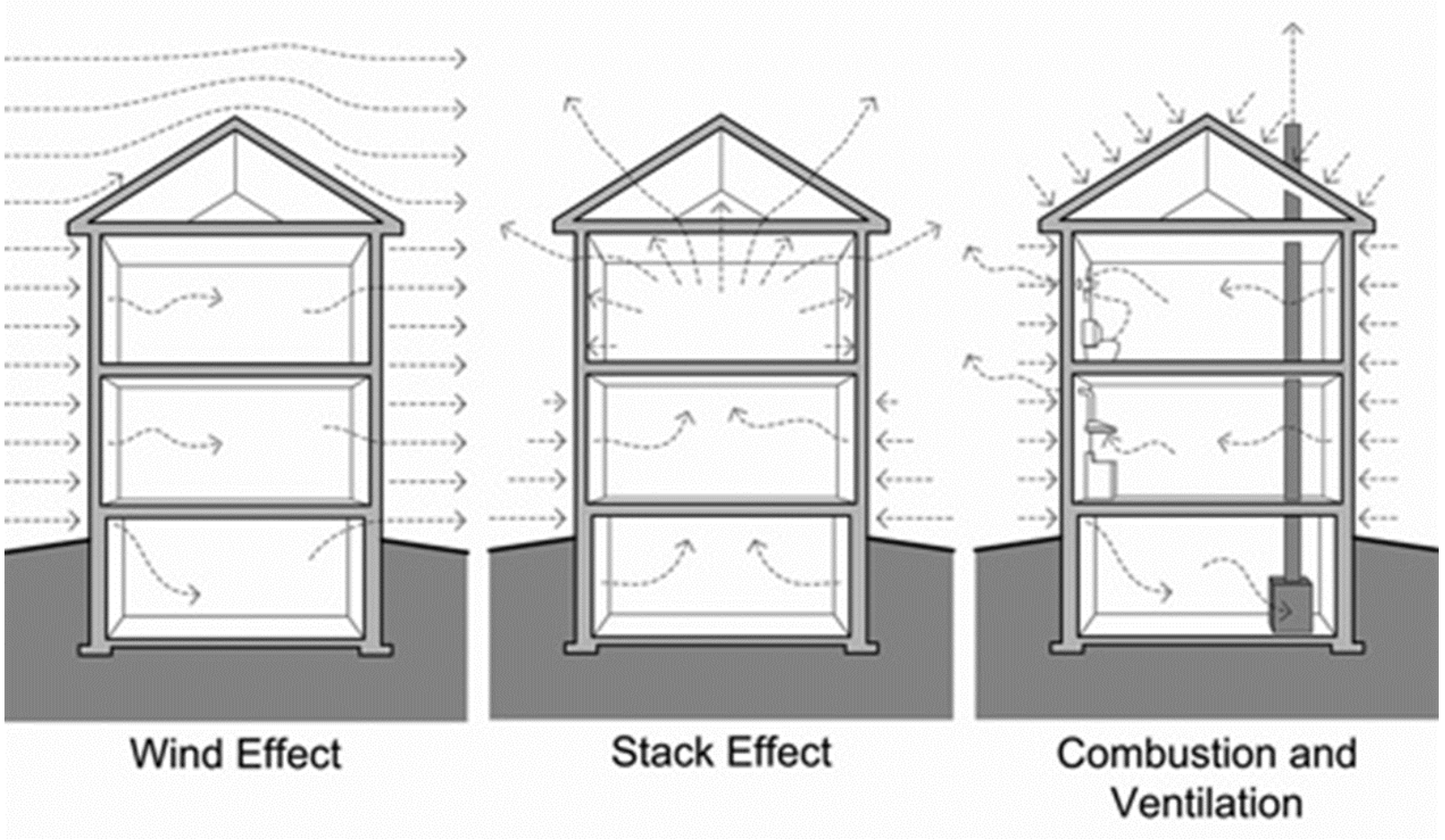
Building Science

Air Flow – Mechanical Effects



Building Science

Air Flow



Building Science of Roof / Wall

Significant pressures at the roof / wall connection due to:

Wind	Stack effect	Mechanical effect

Air wants to be pushed out or pulled in (depending on climate)

Creates areas of high pressure that will magnify air and moisture flow

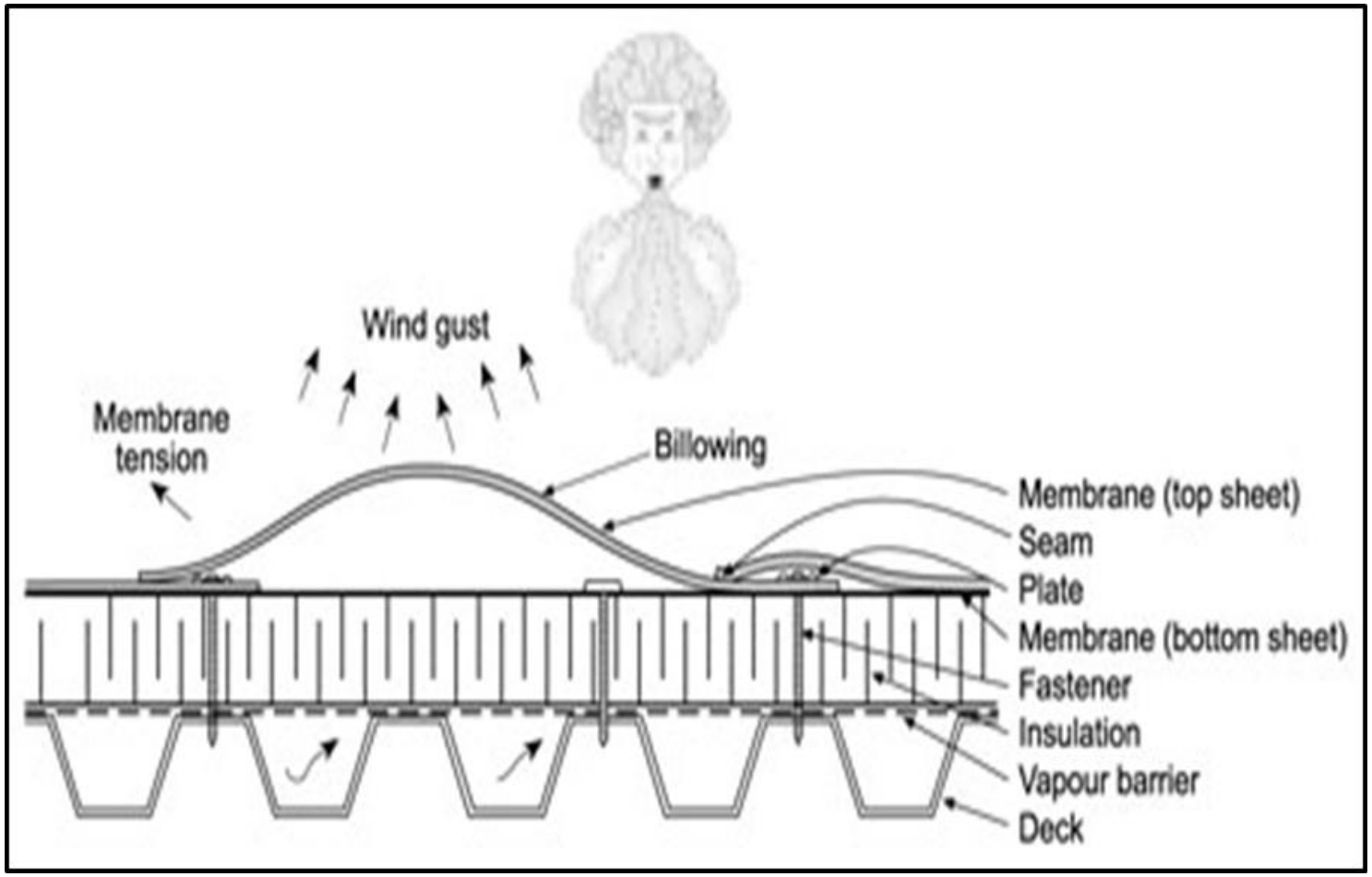
Wall Air Barriers

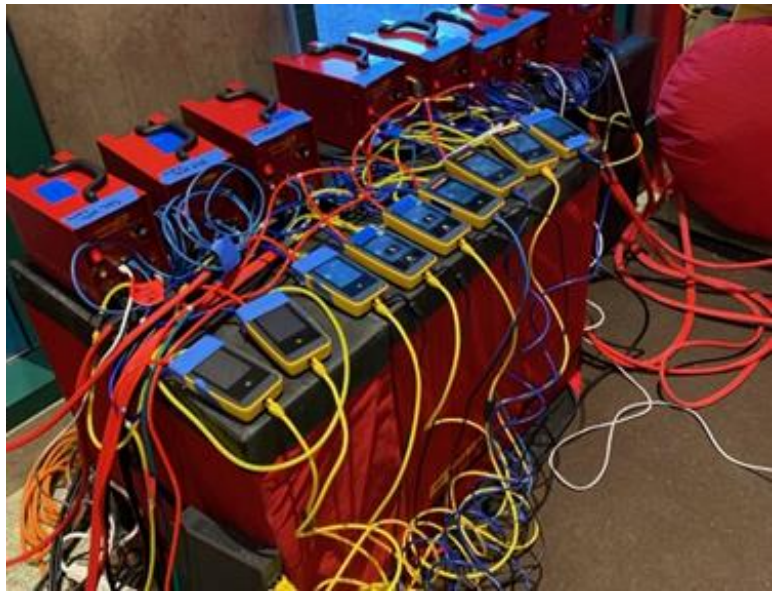
- Key requirements
  - Liquid water impermeable material
  - Continuous
  - Strong: resist positive and negative loads
  - Durable

Roof Air Barriers

- Key requirements
  - Liquid water impermeable material
  - Continuous
  - **Strong: resist positive and negative loads**
  - Durable

Image from Dr. A. Baskaran - NRC





Air Barriers

- Code compliance options – IECC 2015
  - Material
  - Assembly
  - Whole building air tightness

Building Codes

International Energy Conservation Code - IECC

Material C402.5.1.2.1	Assembly C402.5.1.2.2	Building Test C402.4.1.2.3

• ASTM 2178
• 0.004 cfm / ft^2
• List of 16 materials that are acceptable – *provided joints are sealed and installed as an air barrier*
	• ASTM 2357, 1677 or 283
	• 0.04 cfm / ft^2
	• List of 3 assemblies deemed to comply, if joints are sealed
	  • Concrete Masonry Walls (coated with block filler or two coats of a paint or sealant)
	  • Portland Cement / sand parge, stucco or plaster (min ½ inch)
		• ASTM 779
		• 0.40 cfm/ft^2
		• Or equivalent method approved by code official

Types of Air Barriers

- Self-adhered membranes
- Fluid applied membranes
- Sprayed Polyurethane Foams
- Boardstocks
  - Insulating (polyiso, XPS, etc.)
  - Wood, Drywall
- Building Wraps
- Sheathings with pre-applied membrane

Reality of Construction

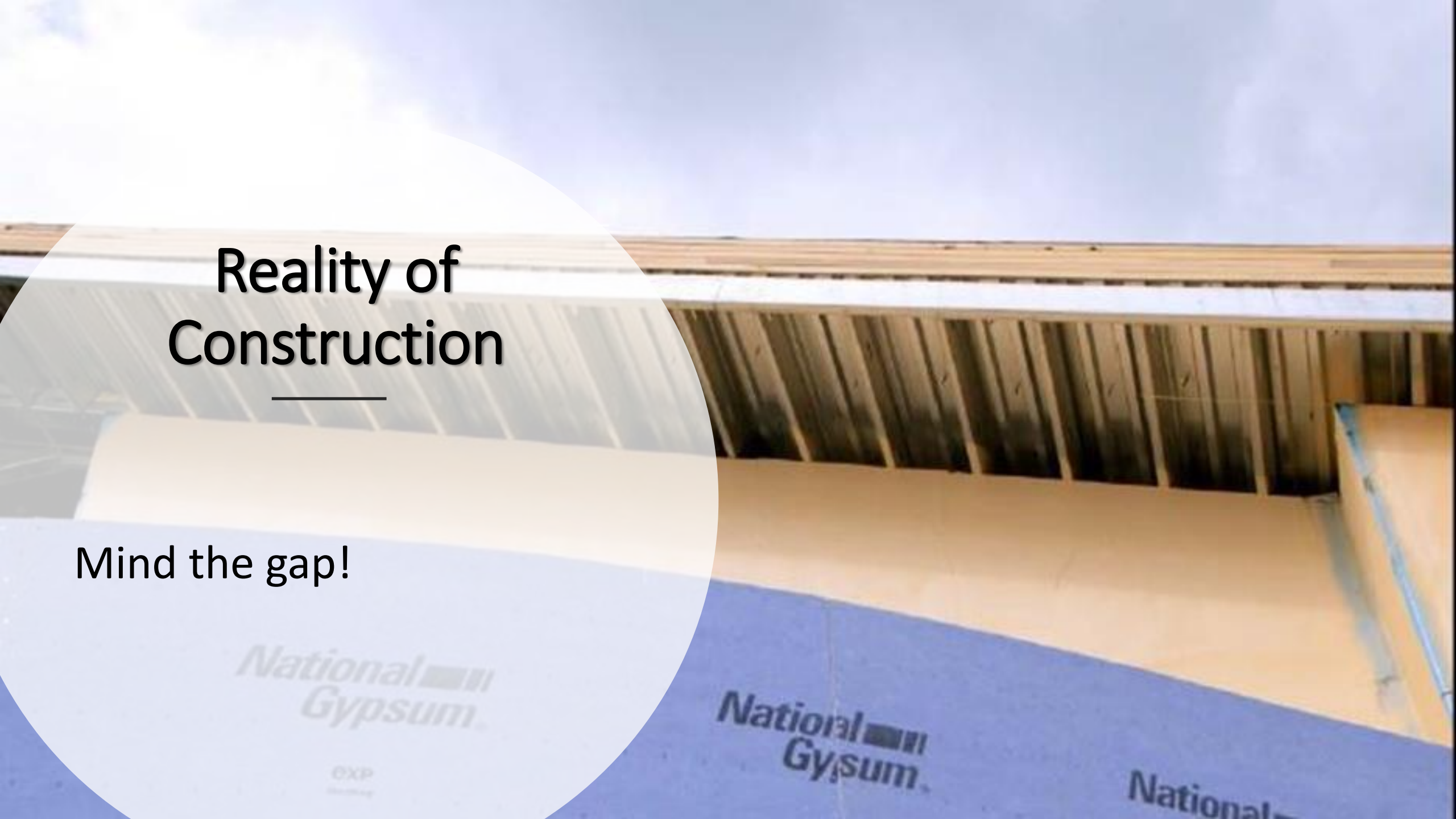
- Wall and roof air barrier have to be continuous

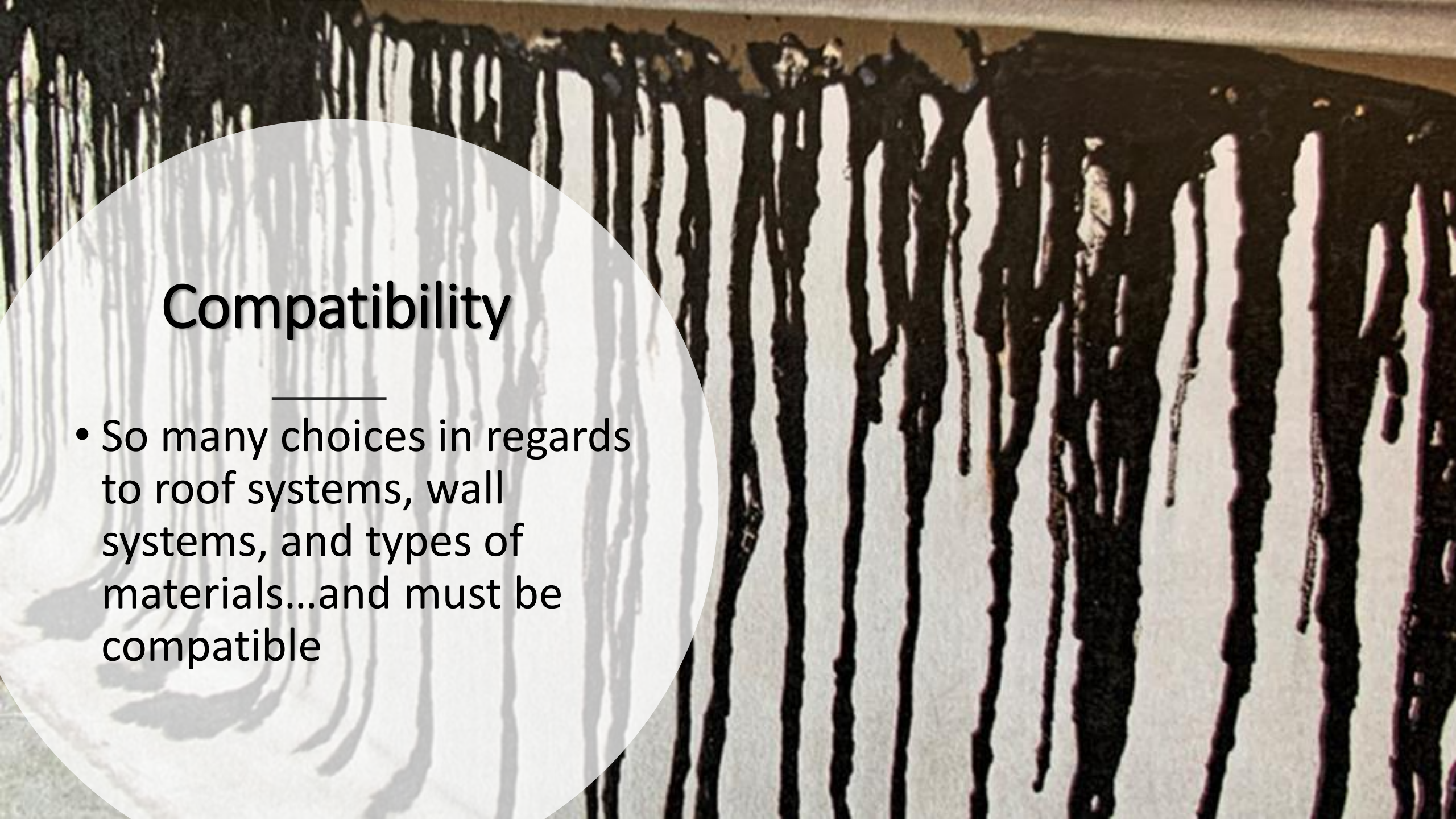
Reality of Construction

- Unadhered membrane
- Reverse lap

Reality of Construction

Mind the gap!





Compatibility

- So many choices in regards to roof systems, wall systems, and types of materials…and must be compatible

Compatibility

Flashing	Arcylic LAB	Asphalt LAB	Polyether LAB	Silicone LAB	Peel & Stick Asphalt Membrane	Peel & Stick Butyl Membrane	Spray Polyurethane Foam	Polystyrene board	Polyiso Board
Copper asphalt									
Copper drainage									
Copper fabric (asphalt)									
Copper fabric (non-asphaltic)									
Copper sheet metal									
EPDM									
EPDM SA (asphalt)									
PVC									
PVC Kee									
PVC Kee SA (asphalt)									
Rubberized asphalt peel & stick									
Stainless steel drainage									
Stainless steel fabric									
Stainless steel self-adhered									
Stainless Steel sheet metal									

Not Compatible
Caution
Compatible

From the ABAA's Flashings and Terminations Committee

Types of Roof Systems

- Single Ply (PVC KEE, TPO, EPDM)
- Multi-Ply
  - BUR
  - Fluid Applied
    - IRMA
    - PMA
    - Modified Bitumen
  - Steep slope (metal, shingles)

Considerations for Single Ply

Single Ply (PVC KEE, TPO, EPDM)

- Not compatible with most rubberized asphalt peel and stick membranes

How to detail

- PVC KEE: transition onto roof deck
- TPO: transition onto roof deck
- EPDM: issues with asphalt

Single Ply (PVC KEE, TPO, EPDM)

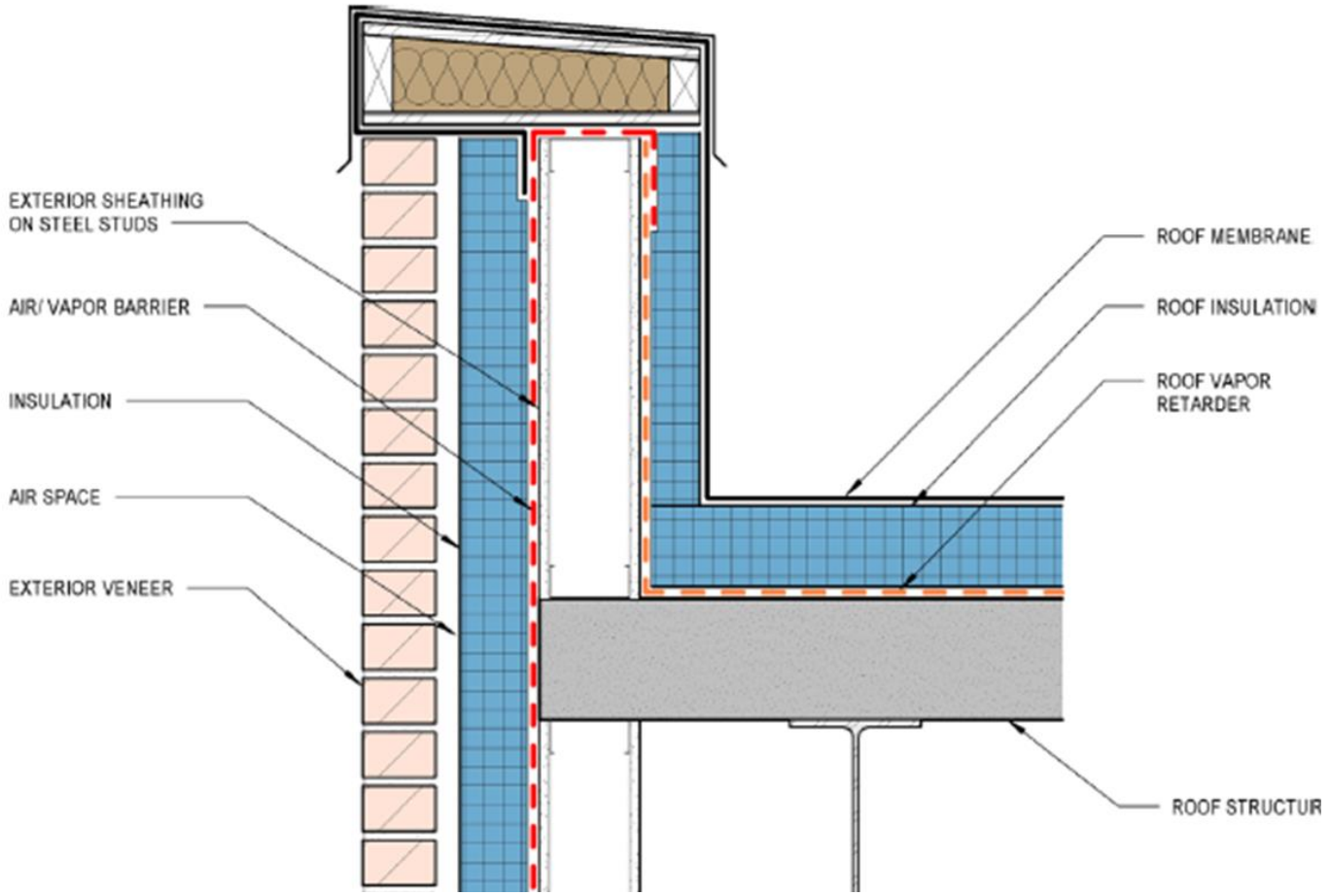


Photo courtesy of Andrew Dunlap, Smith Group

Single Ply (PVC KEE, TPO, EPDM)

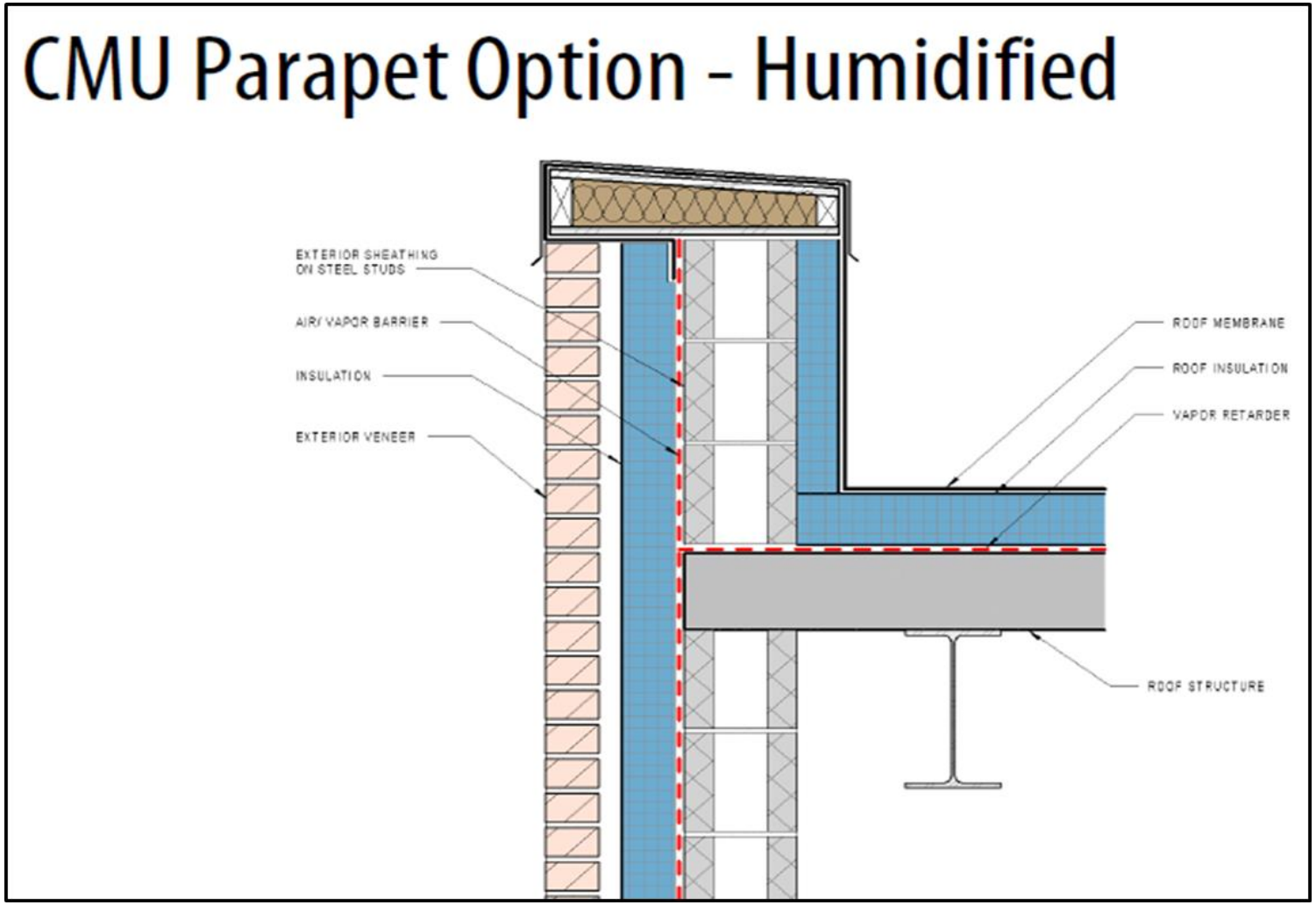


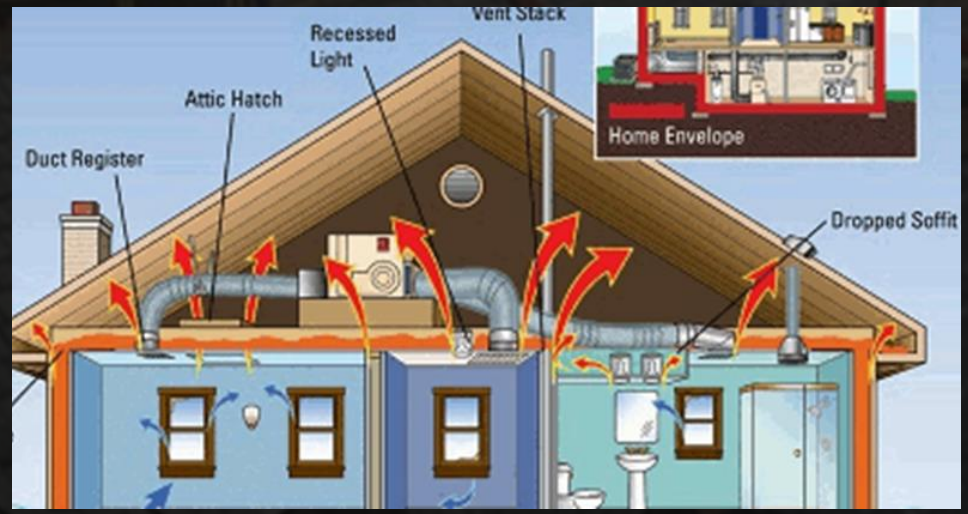
Photo courtesy of Andrew Dunlap, Smith Group

Fluid Applied Wrapping Over Parapet

Considerations for Multi-Ply

- Multi-Ply (BUR, Modified Bitumen, Fluid Applied)
  - No compatibility issues with like asphalts
    - Oliensis Test
  - Recommended getting letter from manufacturers

Consideration for Steep Slope



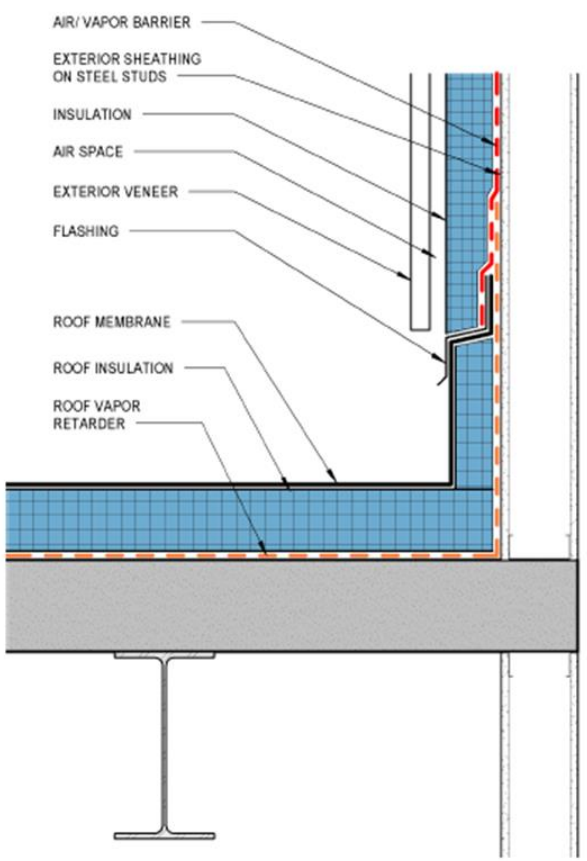
- Connection can be made at ceiling level
  - Seal all penetrations through ceiling

Roof to Wall Connection

What does this have to do with the roof?

Low Roof to High Wall

Low Roof / High Wall



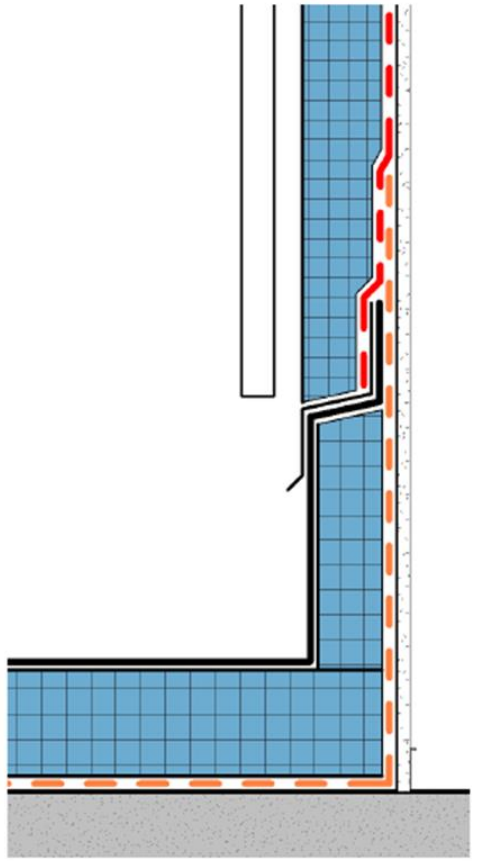
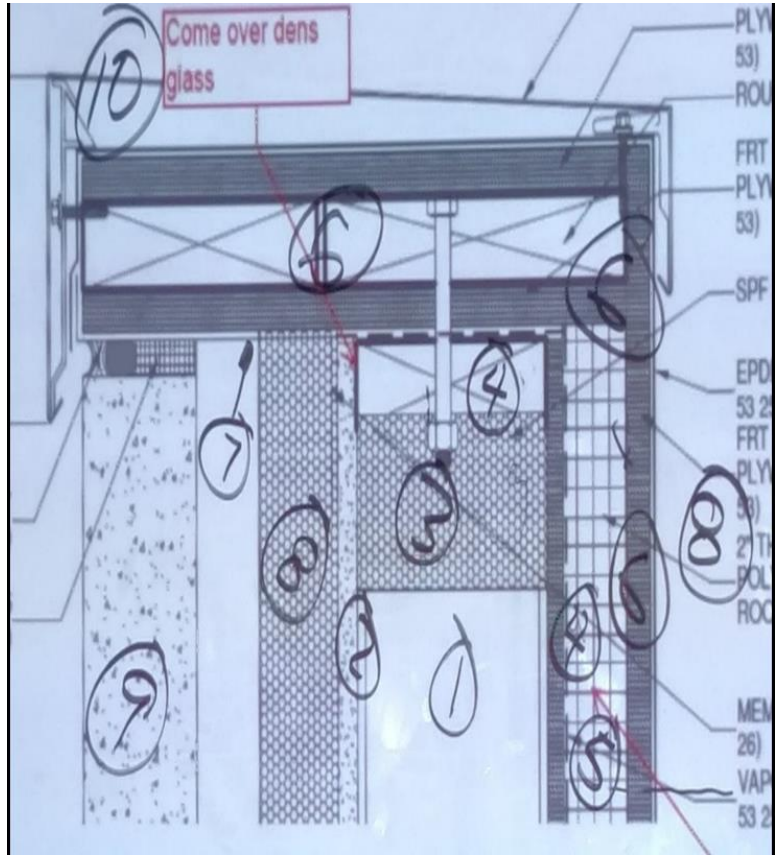


Photo courtesy of Andrew Dunlap, Smith Group



Substrate	Contractor Responsible for Preparation
Glass-Faced Exterior Gypsum	
CMU/Block (should be free of voids)	
Precast/Concrete	
Metal Panel	
Other	

C. Monitoring Installation Temperatures

Product/System	Proper Temperature Range	Contractor Responsible for Verification / Tracking Log
Fluid-applied membrane		
Self-adhered membrane		
Self-adhered transition membrane		
Self-adhered flashing membrane		
Glass-Faced Exterior Gypsum		
Silicone sealant		
2-part Polyurethane Sealant		
Other		

D. Air Barrier Compatibility with Thru-Wall Flashing

Task	Contractor Responsible	By When
Assure compatibility with thru-wall flashing system		
Other		

E. Damage Repair

Component	Product to be Used	Contractor Responsible for Repairs

Roof to Wall Connection - Detailing

- Pre-construction meetings are **critical**
  - Who is responsible for the connection?
  - Sequencing of construction
  - GC’s responsibilities

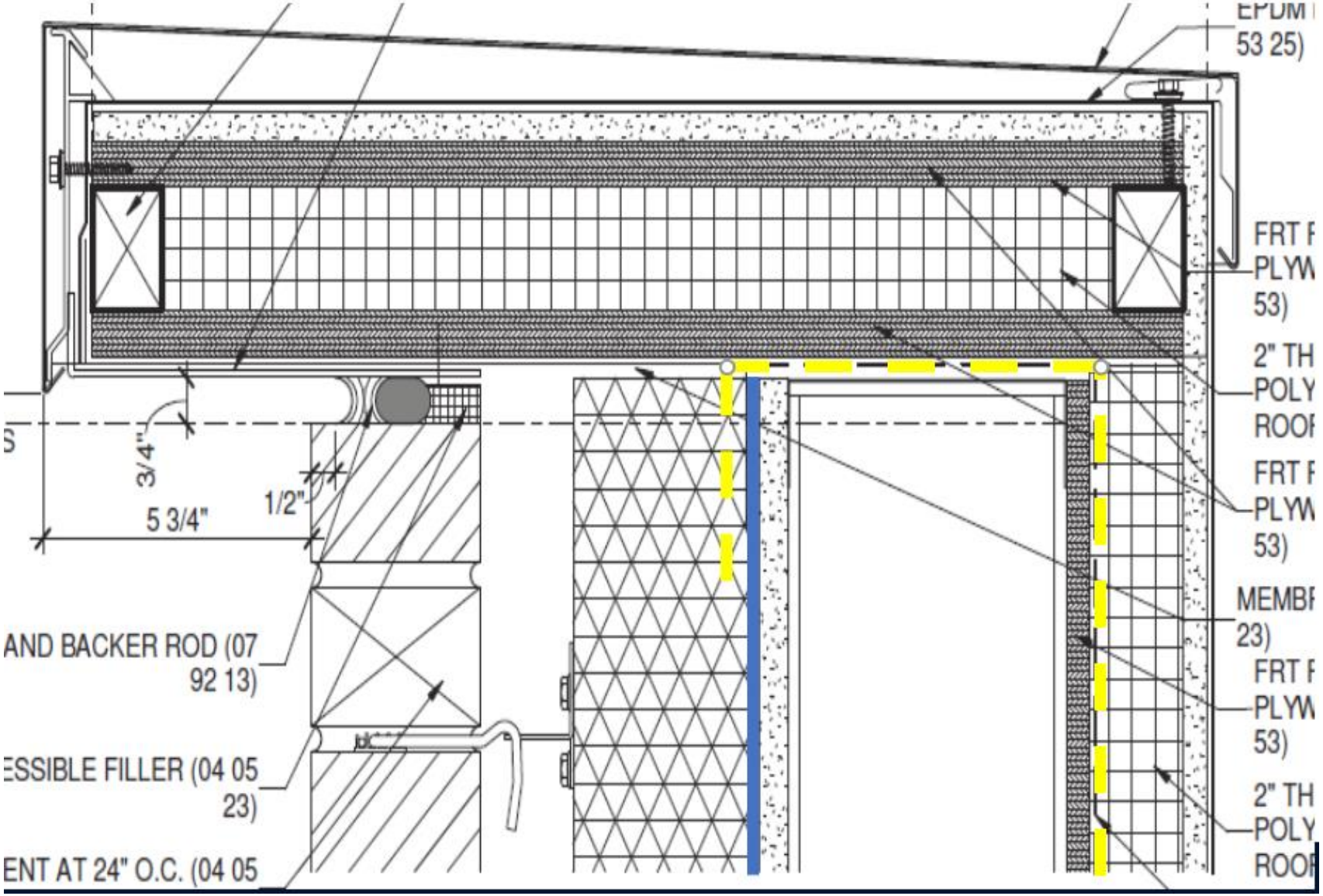
Roof to Wall Connection- Guidance

- Roof membranes are water tight, but may leak air at
  - Parapet
  - HVAC curbs
  - Expansion joints
  - Penetrations

Roof to Wall Connection - Guidance

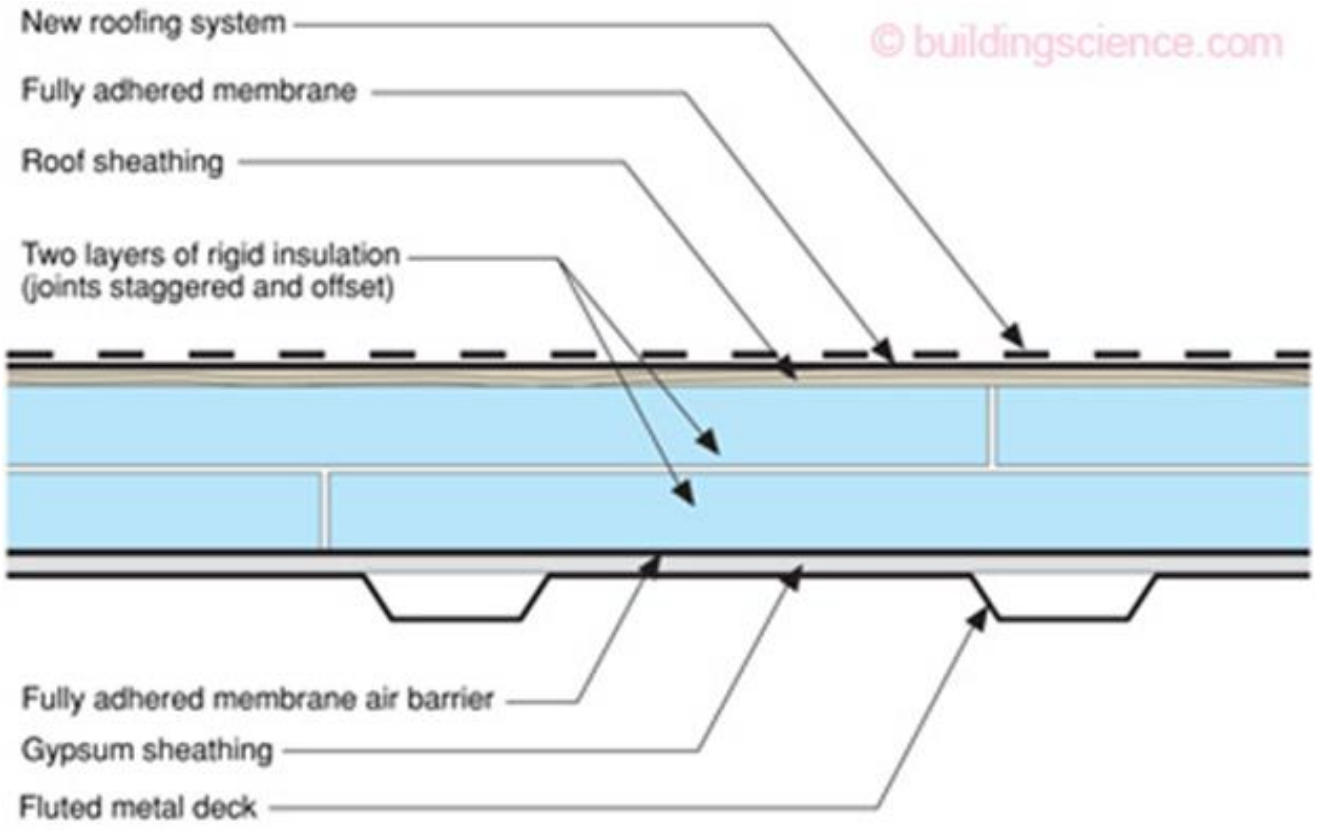
Most common location of air and water leakage is the parapet

Picture courtesy of Tremco


EPDM
53 25)
FRT P
PLYW
53)
2" TH
POLY
ROOF
FRT P
PLYW
53)
MEMBR
23)
FRT P
PLYW
53)
2" TH
POLY
ROOF
3/4"
1/2"
5 3/4"
AND BACKER ROD (07
92 13)
ESSIBLE FILLER (04 05
23)
ENT AT 24" O.C. (04 05

Roof to Wall Connection - Guidance

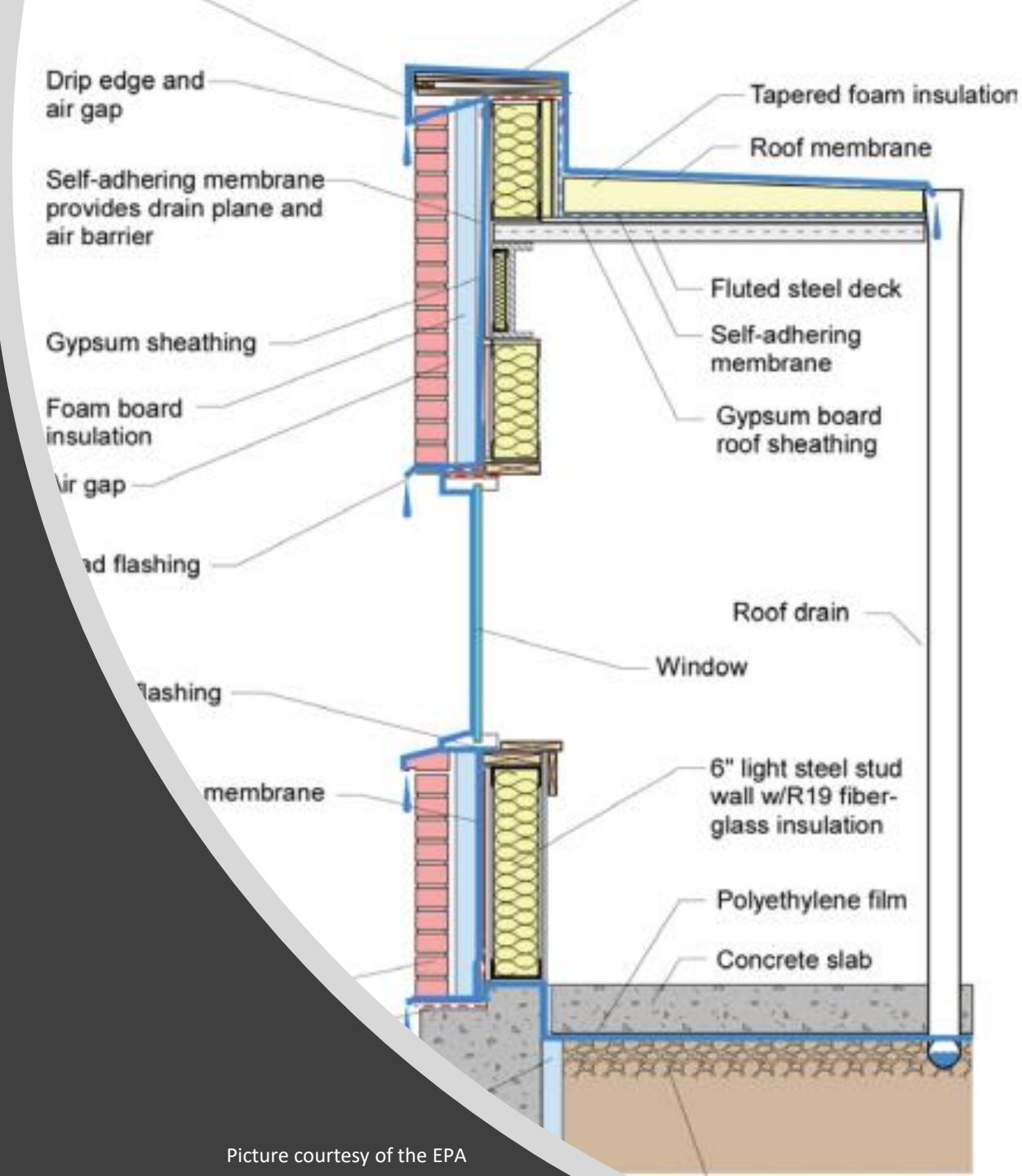
- Some consultants and manufacturers recommend using a fully adhered membrane at the deck level or below most of the insulation
- Performance achieved through
  - Interior air barrier
  - Multiple layers of insulation
  - Cover board
  - Fully adhered membrane



Drawing courtesy of Building Science Corp.

Roof to Wall Connection - Guidance

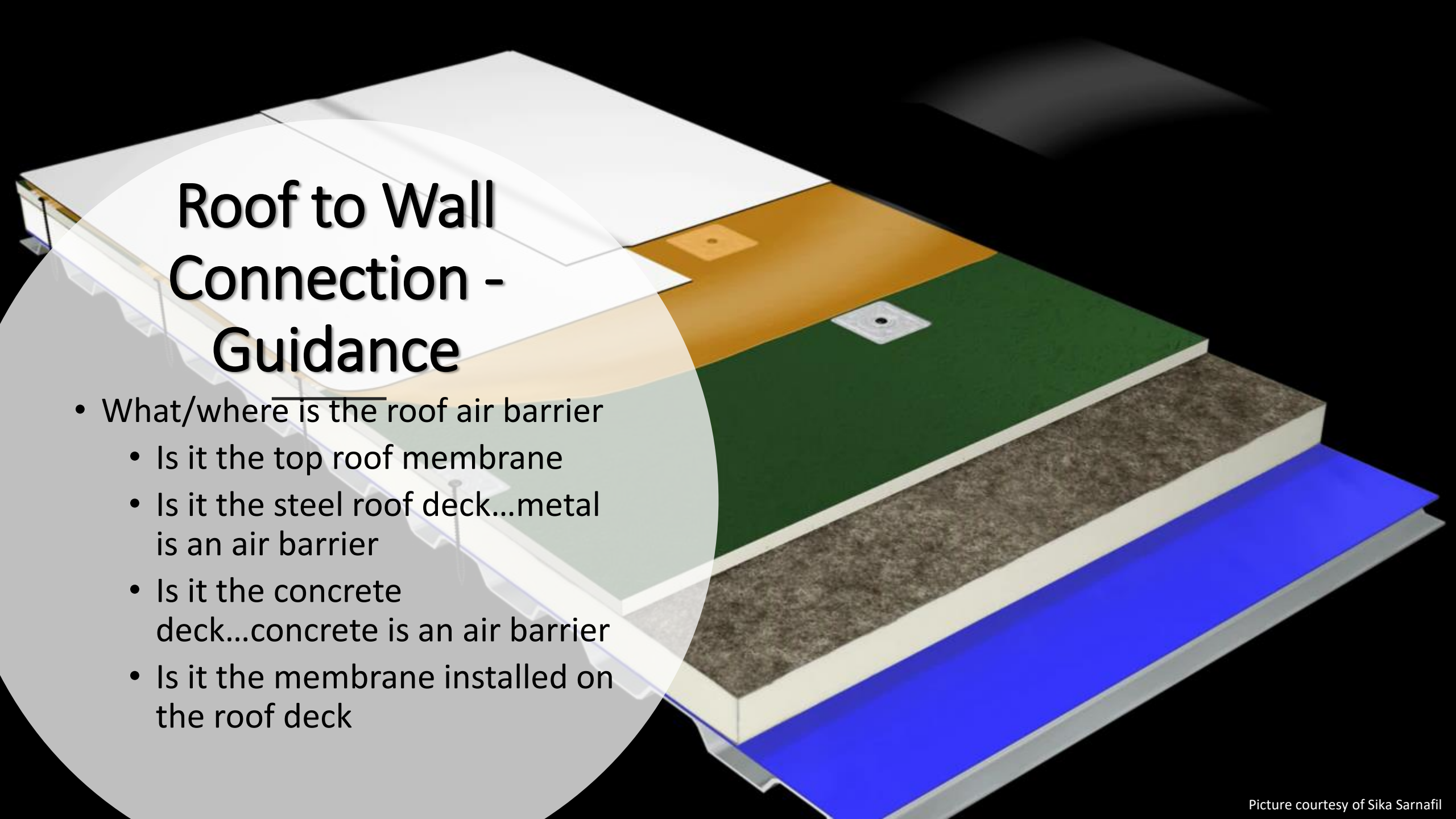
- Roofs are different than walls
  - All materials are vapor impermeable
  - Vapor control layer is located on exterior side of insulation
    - Issue is climate dependent
  - Interior vapor barrier and roof system that has the air and vapor control layer on the exposed side can result in a sandwich for moisture



Picture courtesy of the EPA

Roof to Wall Connection - Guidance

- What/where is the roof air barrier
  - Is it the top roof membrane
  - Is it the steel roof deck…metal is an air barrier
  - Is it the concrete deck…concrete is an air barrier
  - Is it the membrane installed on the roof deck



Picture courtesy of Sika Sarnafil

Roof to Wall Connection - Guidance

Transition of wall air barrier to underside of the metal roof deck

Considerations for SPF

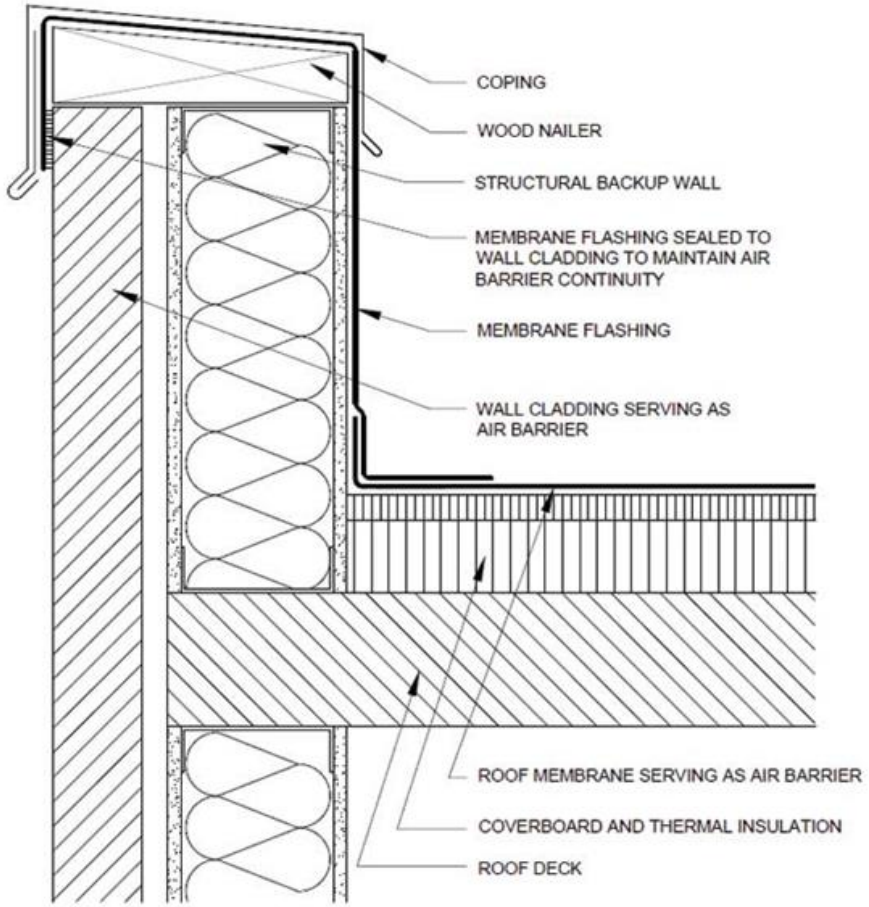
- Similar transition to Single Ply
  - Make the connection at the roof deck

Roof to Wall Connection - Guidance

- Transition of wall air barrier to concrete roof deck

Roof to Wall Connection - Guidance

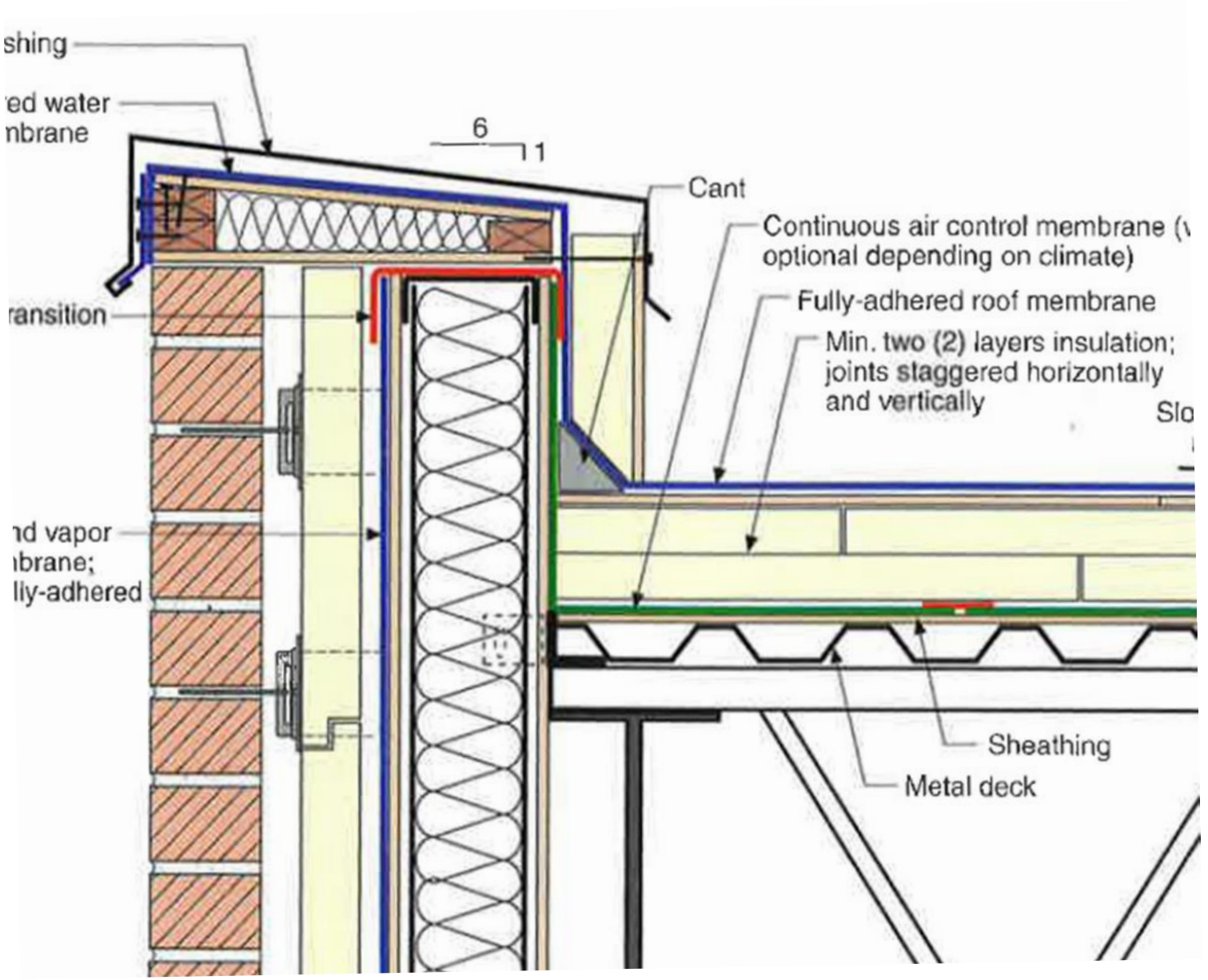
- What/where is the roof air barrier
  - Identify clearly in the drawings what is providing
    - Water control layer
    - Air barrier layer
    - Vapor barrier layer

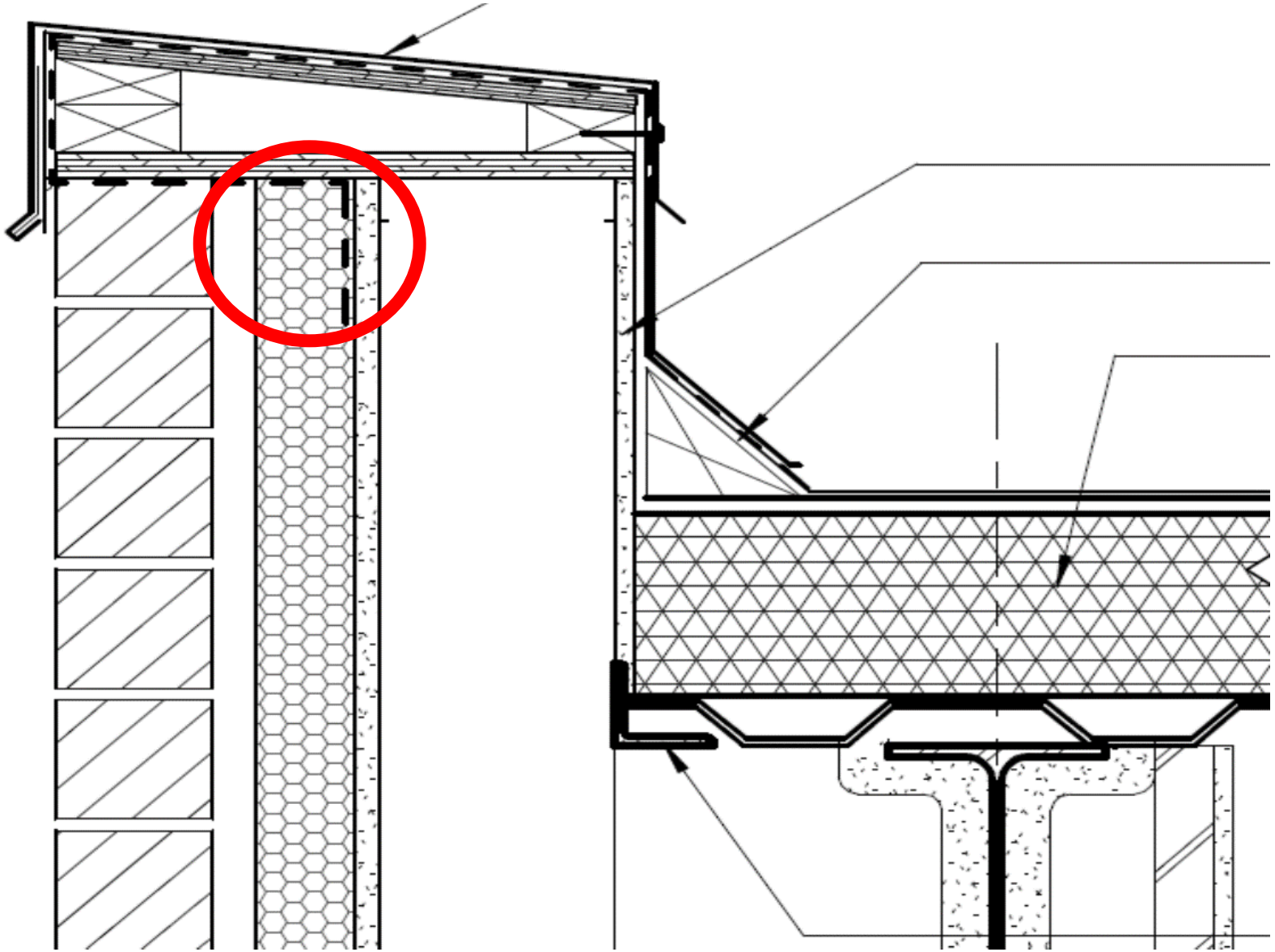


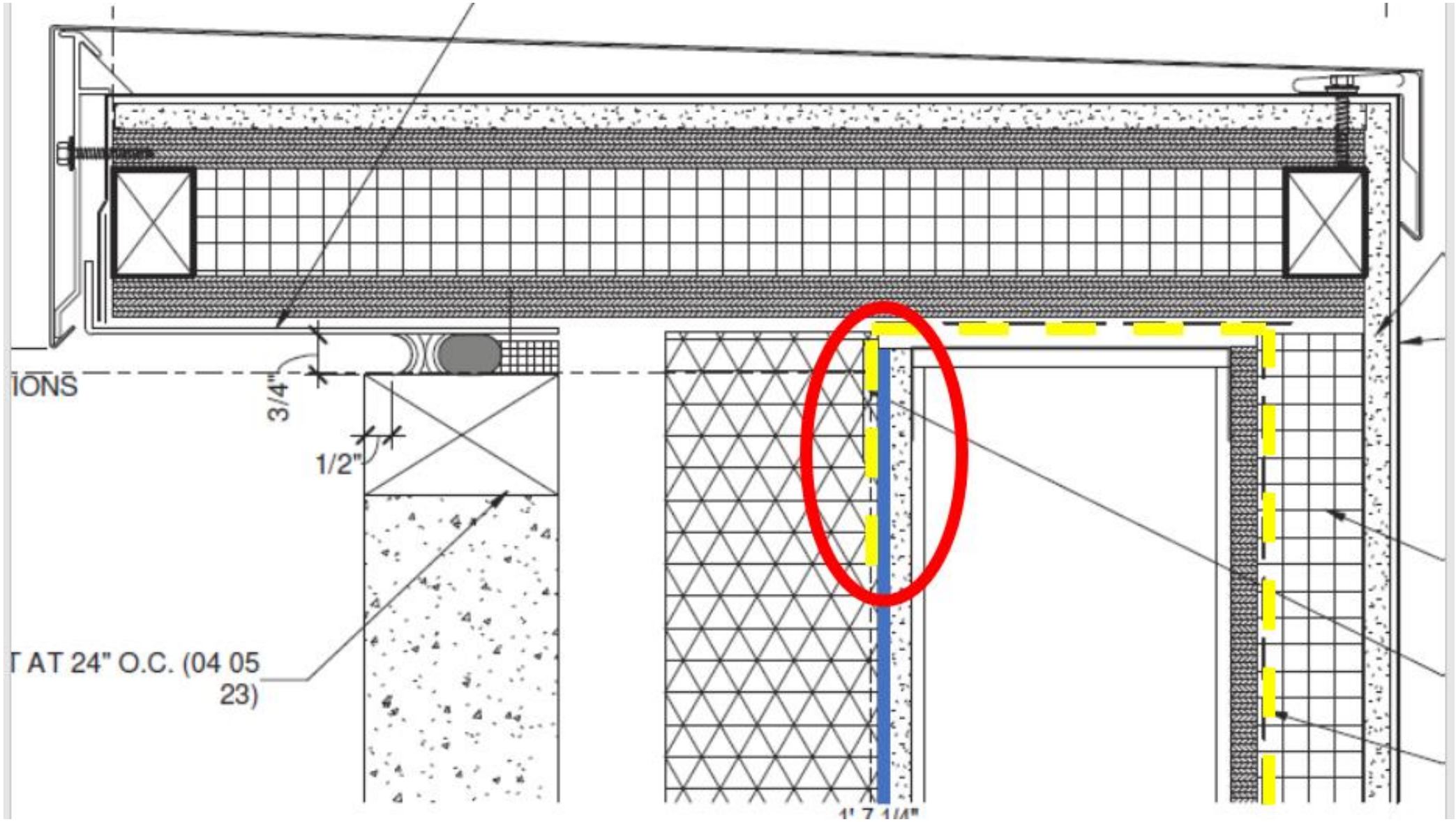
NOTE: THIS FIGURE IS MEANT TO CONCEPTUALLY DEPICT AN AIR BARRIER SYSTEM IN A BUILDING ENVELOPE. IT IS NOT INTENDED TO BE A CONSTRUCTION DETAIL.

Roof to Wall Connection - Guidance

Photo courtesy of John Straube



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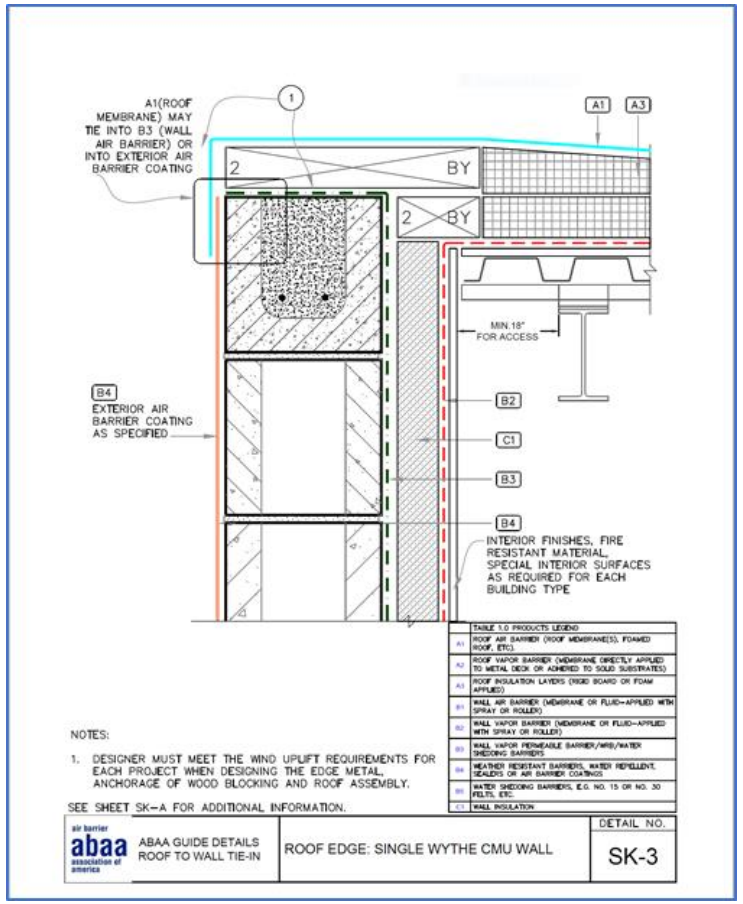
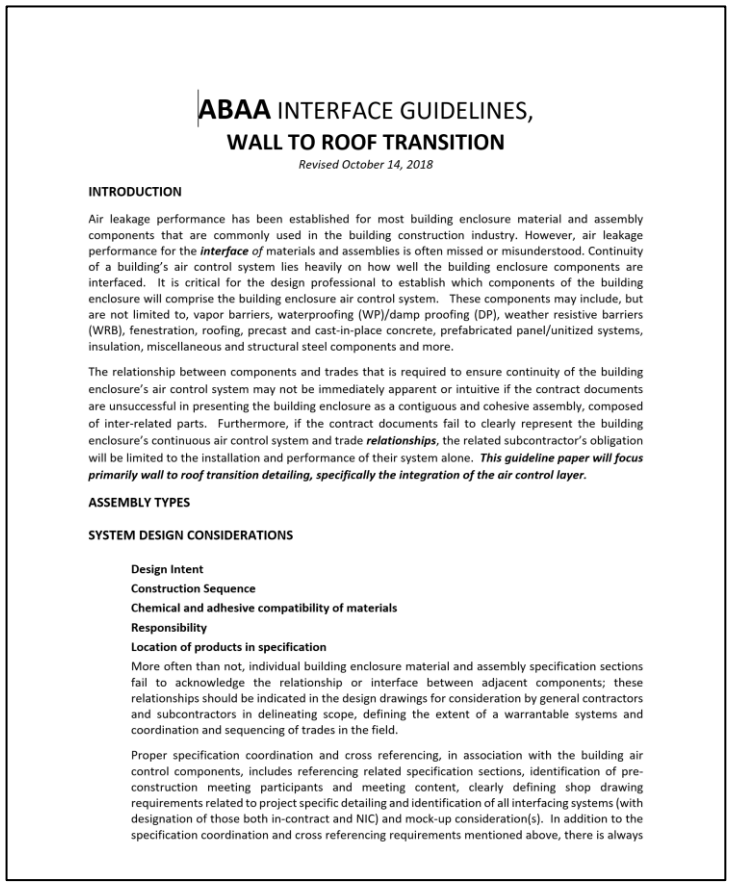
23)

ABAA Resources

ABAA has Regional Advocates who can provide guidance





ABAA INTERFACE GUIDELINES,

WALL TO ROOF TRANSITION

Revised October 14, 2018

INTRODUCTION

Air leakage performance has been established for most building enclosure material and assembly components that are commonly used in the building construction industry. However, air leakage performance for the ***interface*** *of* materials and assemblies is often missed or misunderstood. Continuity of a building's air control system lies heavily on how well the building enclosure components are interfaced. It is critical for the design professional to establish which components of the building enclosure will comprise the building enclosure air control system. These components may include, but are not limited to, vapor barriers, waterproofing (WP)/damp proofing (DP), weather resistive barriers (WRB), fenestration, roofing, precast and cast-in-place concrete, prefabricated panel/unitized systems, insulation, miscellaneous and structural steel components and more.

The relationship between components and trades that is required to ensure continuity of the building enclosure's air control system may not be immediately apparent or intuitive if the contract documents are unsuccessful in presenting the building enclosure as a contiguous and cohesive assembly, composed of inter-related parts. Furthermore, if the contract documents fail to clearly represent the building enclosure's continuous air control system and trade ***relationships***, the related subcontractor's obligation will be limited to the installation and performance of their system alone. ***This guideline paper will focus primarily wall to roof transition detailing, specifically the integration of the air control layer.***

ASSEMBLY TYPES

SYSTEM DESIGN CONSIDERATIONS

Design Intent

Construction Sequence

Chemical and adhesive compatibility of materials

Responsibility

Location of products in specification

More often than not, individual building enclosure material and assembly specification sections fail to acknowledge the relationship or interface between adjacent components; these relationships should be indicated in the design drawings for consideration by general contractors and subcontractors in delineating scope, defining the extent of a warrantable systems and coordination and sequencing of trades in the field.

Proper specification coordination and cross referencing, in association with the building air control components, includes referencing related specification sections, identification of pre-construction meeting participants and meeting content, clearly defining shop drawing requirements related to project specific detailing and identification of all interfacing systems (with designation of those both in-contract and NIC) and mock-up consideration(s). In addition to the specification coordination and cross referencing requirements mentioned above, there is always

Things to remember

Roof/Wall transitions need careful detailing in drawings

Understand the chemical compatibility between roofing membranes and various types of air barriers

Sequencing of construction is critical.

Identify who is responsible for the final connection

Roy F. Schauffele, FCSI, CCPR, FABAA, LEED Green Assoc., CABS

Certified Air Barrier Specialist #007007

Division 7 Solutions, Inc.

ABAA Past Chairman

Philadelphia Eagles fan

roys@division7.com

(210) 859-3749

Air Barrier Association of America

Ryan Dalgleish COO

rdalgleish@airbarrier.org

Ph. (866) 956-5888

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