Air Barrier Considerations for Roof/Wall Intersections

Presented By

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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

- Become aware of compatibility issues related to wall and roof air barrier components

LEARNING OBJECTIVES

- Understand why the roof/wall air barrier is important

LEARNING OBJECTIVES

- Become aware of different types of air barrier and how they may integrate into the roof assembly

LEARNING OBJECTIVES

- Understand basic requirements for detailing and sequence of construction for the most common roof/wall air barrier connections

ROOF / WALL CONNECTIONS

- Why do we care ?
  - Building Science tells us so
  - One of the most significant area's that causes problems in regards to air leakage (windows are # 1)
  - Provides "largest" holes in the air barrier system
  - So many choices in regards to roof systems, wall systems and types of materials that must connect

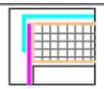
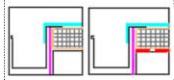
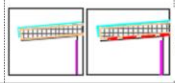
How Many Products
Do We Build With Today?

Let's Consider the Following:

- 3 Different Types of Back Up Walls
  - Block, OSB, Exterior Sheathing
- **5 Different Types of AVB**
  - **Fluid, Self Adhered, SPF, Rigid, Mechanically Fastened**
- 4 Different Types of Insulation
  - SPF, Extruded Poly, Poly Iso, Mineral Wool
- 4 Different Types of Exterior Cladding
  - Brick, Metal Panel, EFIS, Cement Board
- ***OVER 116*** **Wall Configurations**
  - This **DOES NOT** Consider all of the **Different Manufacturers** of each Item

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																

What about roof/wall connections ?

16 roof types
10 air barriers
X amount of connections ?

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)

BUILDING SCIENCE

- What are we actually trying to do with the air barrier ?
  - Reduce Air Flow
  - Reduce Moisture Flow

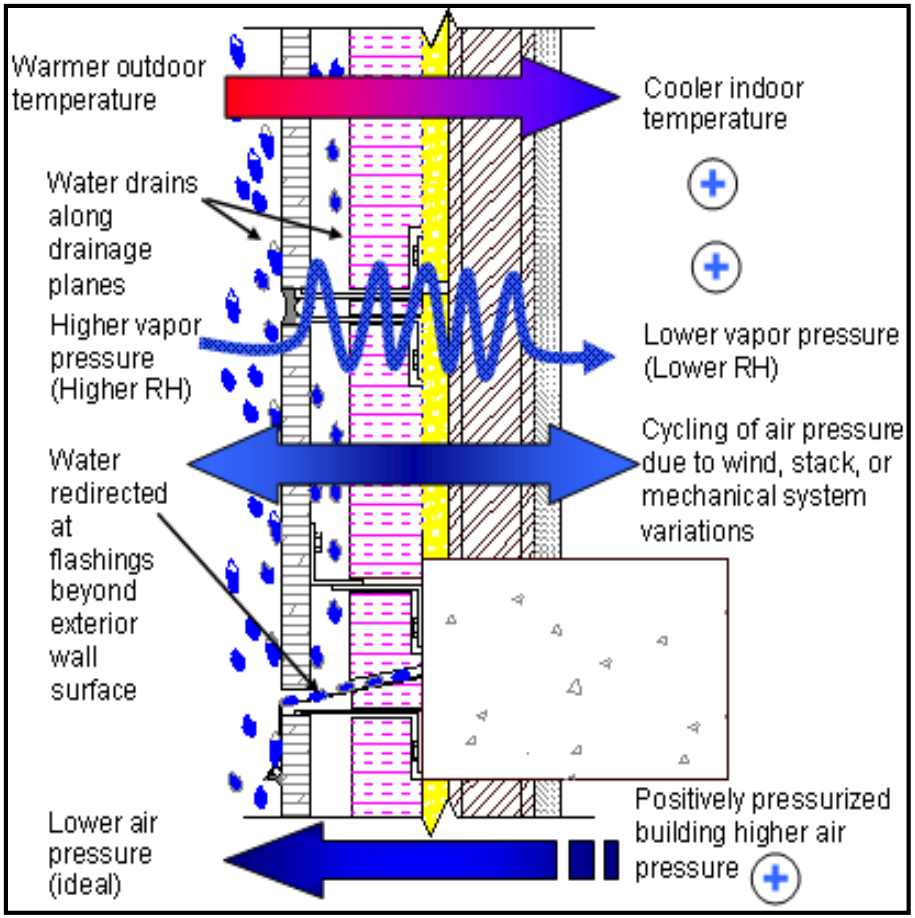
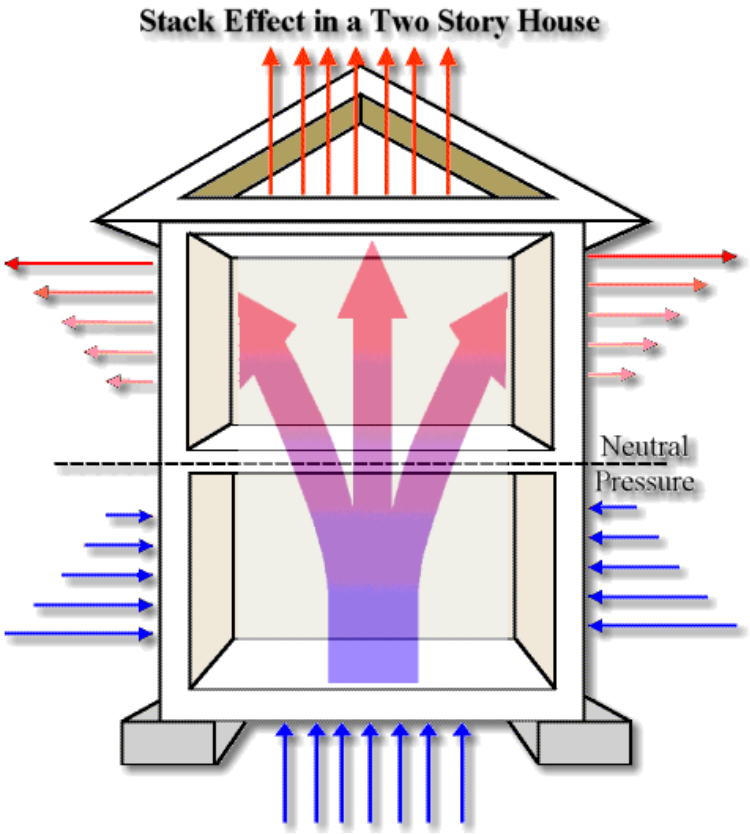
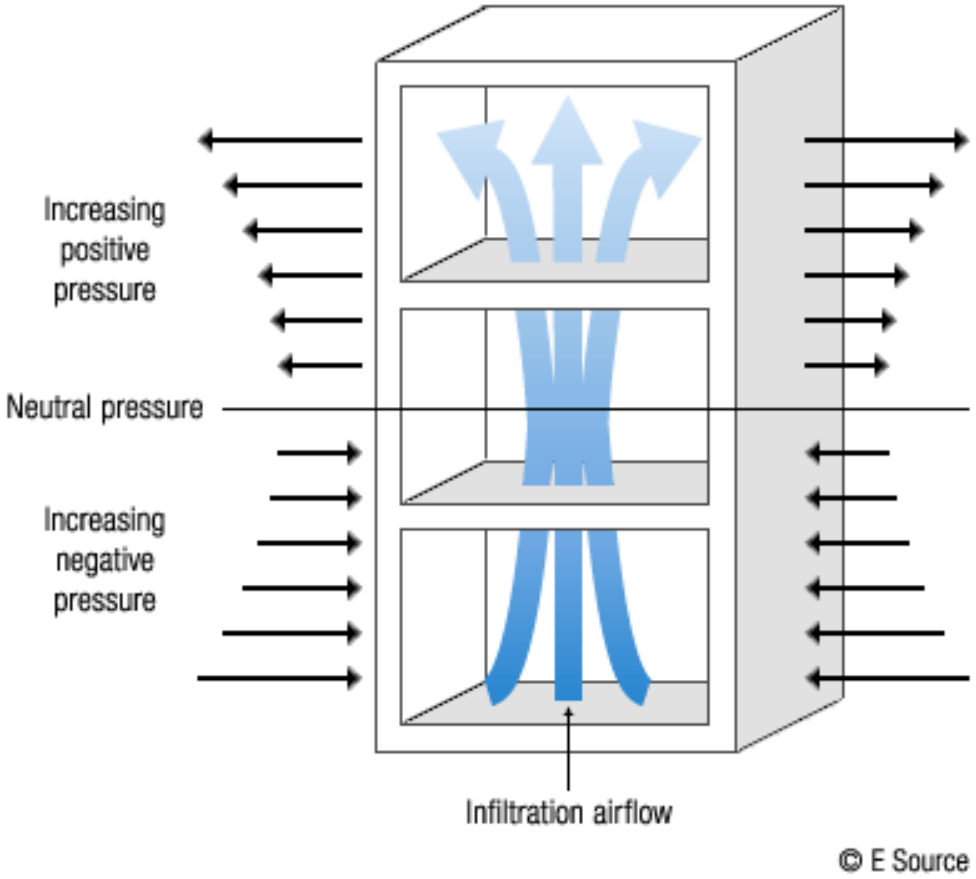


Figure 6. Moisture Transfer Diagram ("Hot-humid" climate shown)
Whole Building Design Guide

BUILDING SCIENCE

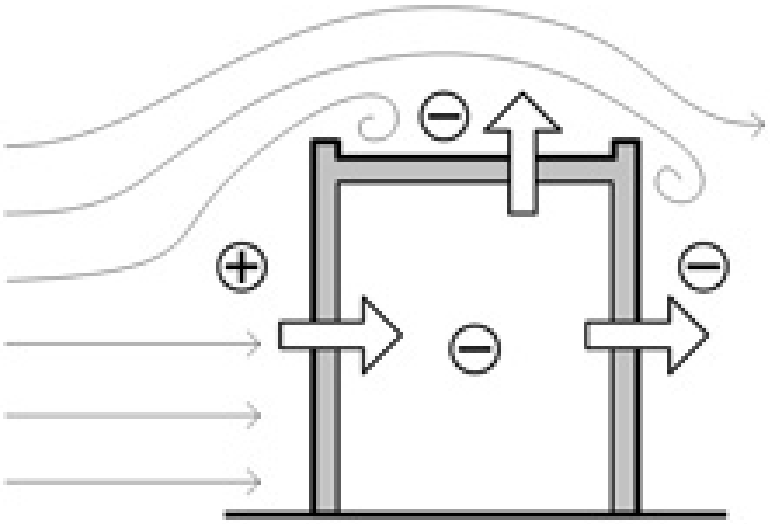
AIR FLOW – STACK EFFECT

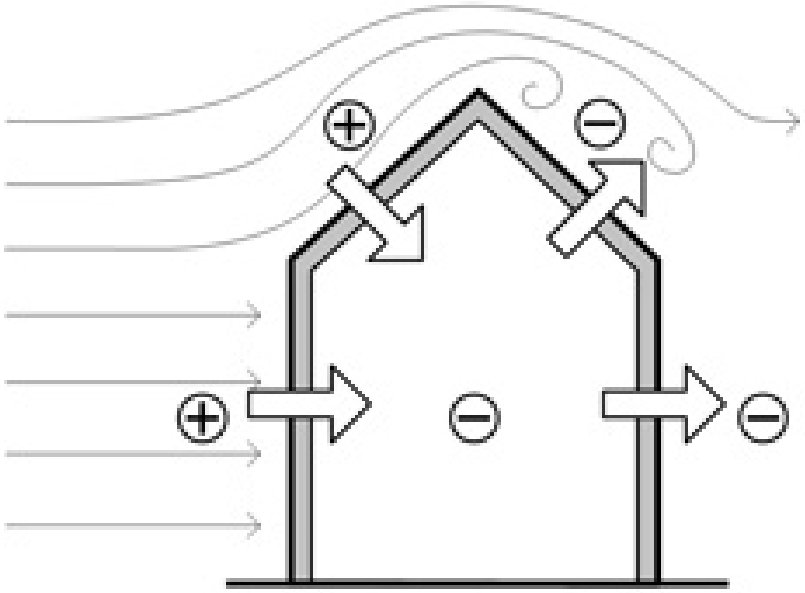




BUILDING SCIENCE

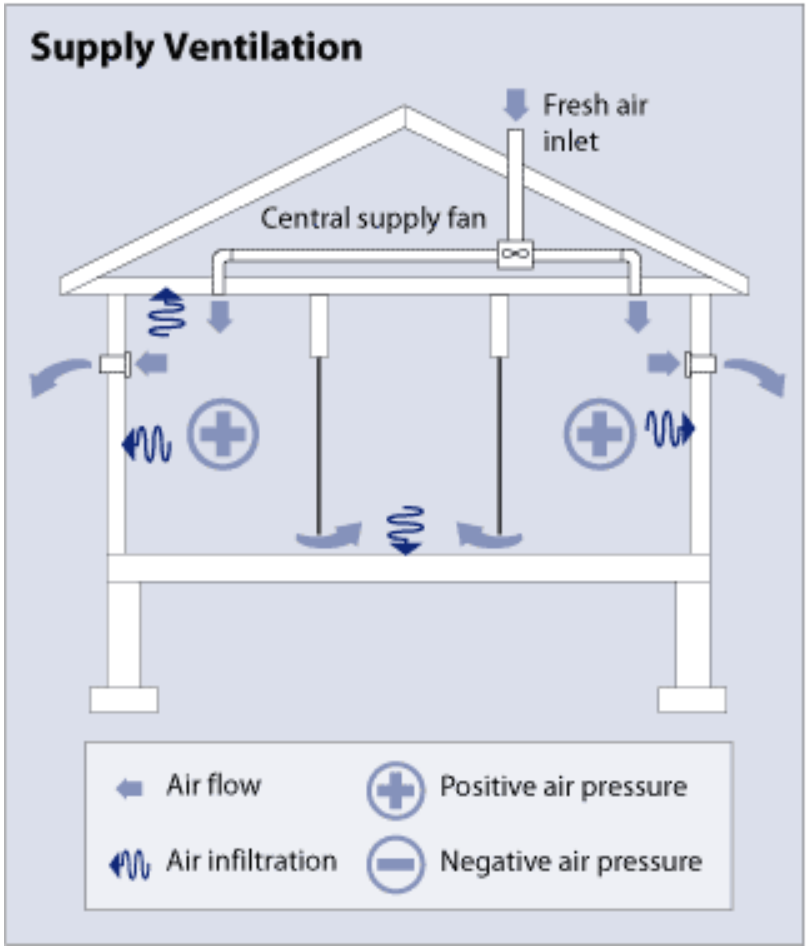
AIR FLOW – WIND EFFECT





BUILDING SCIENCE

AIR FLOW – MECHANICAL EFFECTS

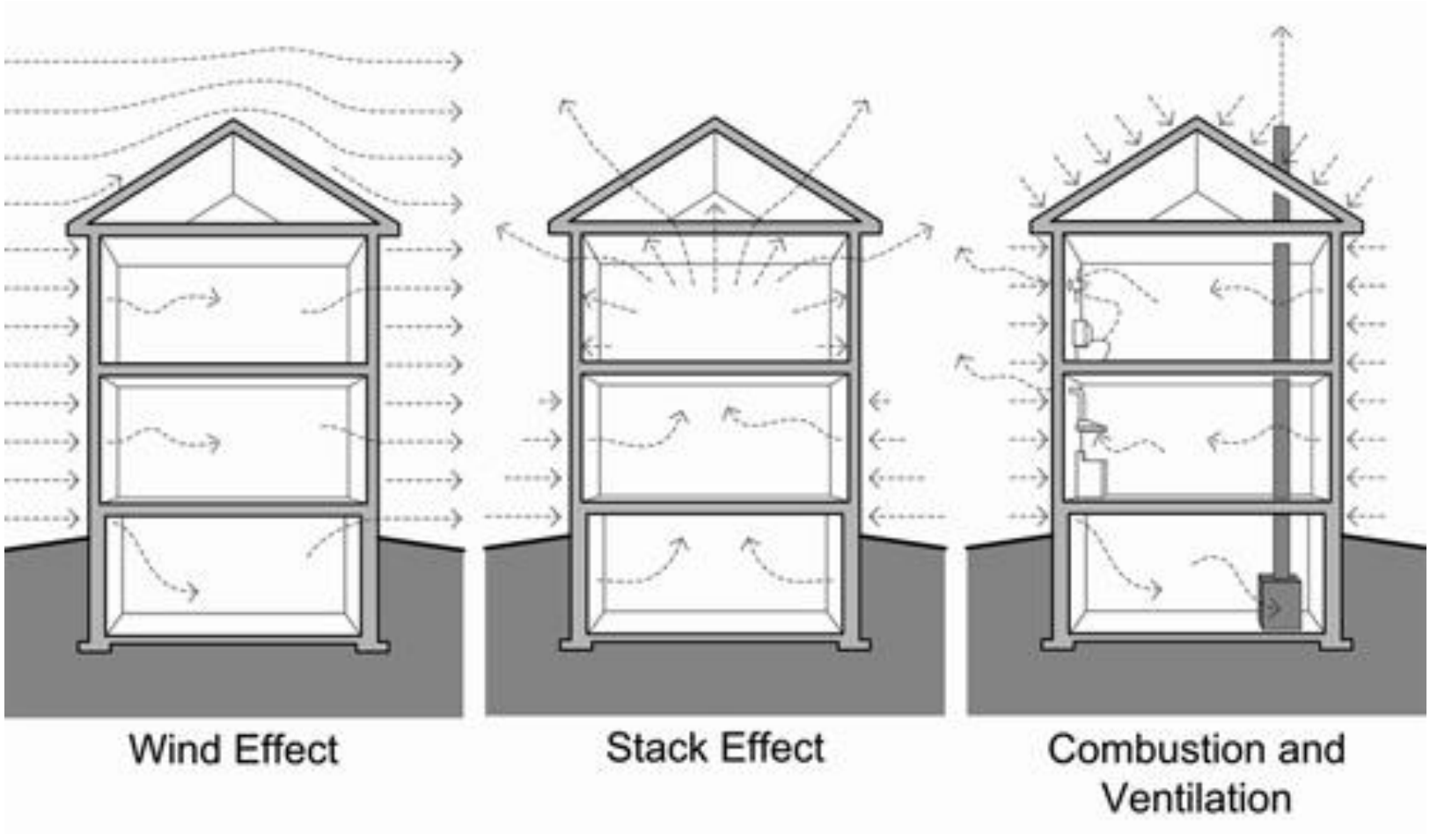


ROOF / WALL CONNECTIONS

- So, what does this have to do with the Roof ?
  - Significant pressures at roof wall connection due to wind, stack effect and mechanical effect
    - Air wants to be pushed out or pulled in, depending on climate
    - Creates an area of high pressure that will exaggerate air and moisture movement

BUILDING SCIENCE

AIR FLOW



AIR BARRIERS FOR WALLS

KEY REQUIREMENTS

- Impermeable material
- Continuous
- Strong: resist positive and negative loads
- Durable

AIR BARRIERS FOR ROOFS

KEY REQUIREMENTS

- Impermeable material
- Continuous
- Strong: resist positive and negative loads
- Durable

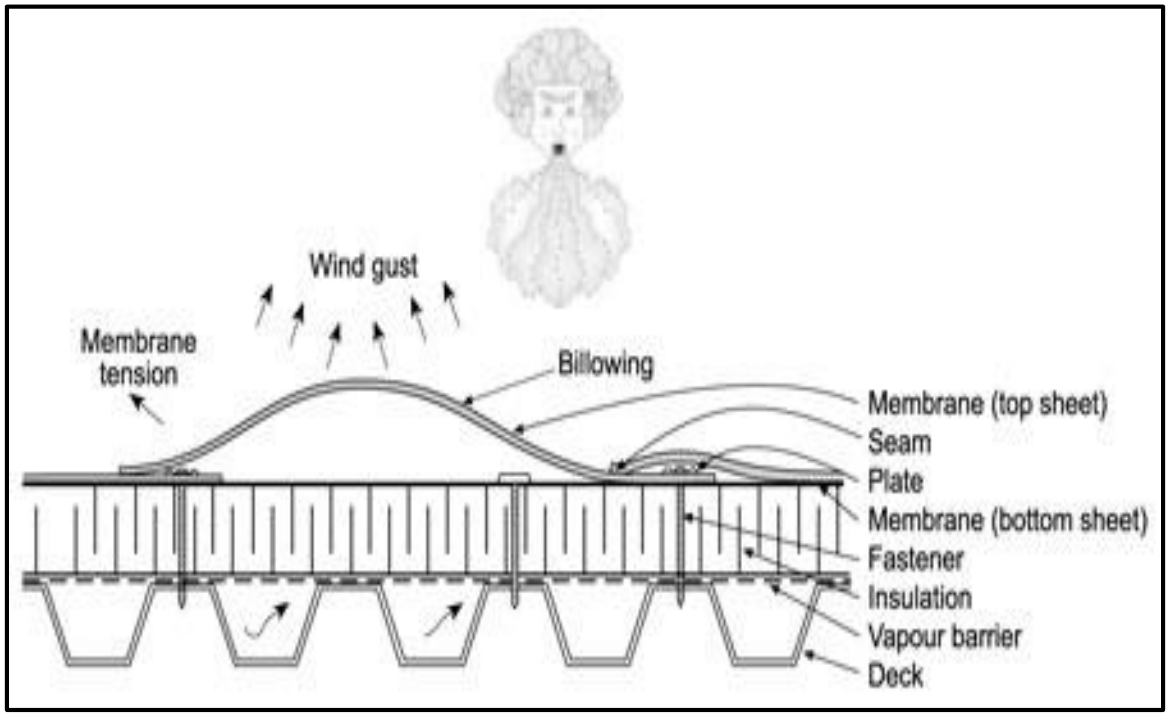


Image from Dr. A. Baskaran - NRC

AIR BARRIERS

CODE COMPLIANCE OPTIONS – IECC 2015

- Material (easy)
- Assembly (more realistic)
- Whole Building Airtightness (confirmation)

BUILDING CODES

INTERNATIONAL ENERGY CONSERVATION CODE

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

BUILDING CODES

INTERNATIONAL ENERGY CONSERVATION CODE

Material C402.5.1.2.1	Assembly C402.5.1.2.2

• Roof Materials listed in IECC:
  • Built-Up Roofing Membrane
  • Modified Bituminous Roof Membrane
  • Fully Adhered Single Ply Roof Membrane
  • Sheet Steel
	• Roof Assemblies listed in IECC:
	  • No Assemblies specifically listed, ASTM 2357 is compliance method

TYPES OF AIR BARRIERS THAT NEED TO CONNECT TO ROOF

- Self-Adhered Membranes (permeable/non-permeable)
- Fluid Applied Membranes (permeable/non-permeable)
  - Various types of chemical compositions
- Sprayed Polyurethane Foam
- Boardstock
  - Insulating (polyiso, XPS, etc)
  - Wood/Drywall
- Commercial Building Wraps
- Factory Applied Membranes to Sheathing

TYPES OF AIR BARRIERS

MATERIAL CHOICES

REALITY OF CONSTRUCTION

Discontinuity of wall air barrier to roof and metal roof deck

REALITY OF CONSTRUCTION

Unadhered Membrane

Reverse Laps

REALITY OF CONSTRUCTION

That is quite the Gap !

TYPES OF ROOF SYSTEM

- Single Ply Systems (PVC, TPO, EPDM)
- Multi-Ply Systems
  - BUR
  - Modified Bitumen
  - Hot/Cold Fluid Applied (IRMA/PMA/Mod Bits)
- Steep Slope
  - Metal
- Sprayed Polyurethane Foam

CONSIDERATIONS FOR EACH ROOF SYSTEM

- Single Ply Systems (PVC, TPO, EPDM)
  - PVC, TPO and EPDM are not compatible with most self-adhered membranes (specific to modified asphalts)
- How to detail ?
  - PVC: Transition onto Roof Deck
  - TPO: Transition onto Roof Deck
  - EPDM: Issues with Asphalt

- Single Ply Systems (PVC, TPO, EPDM)

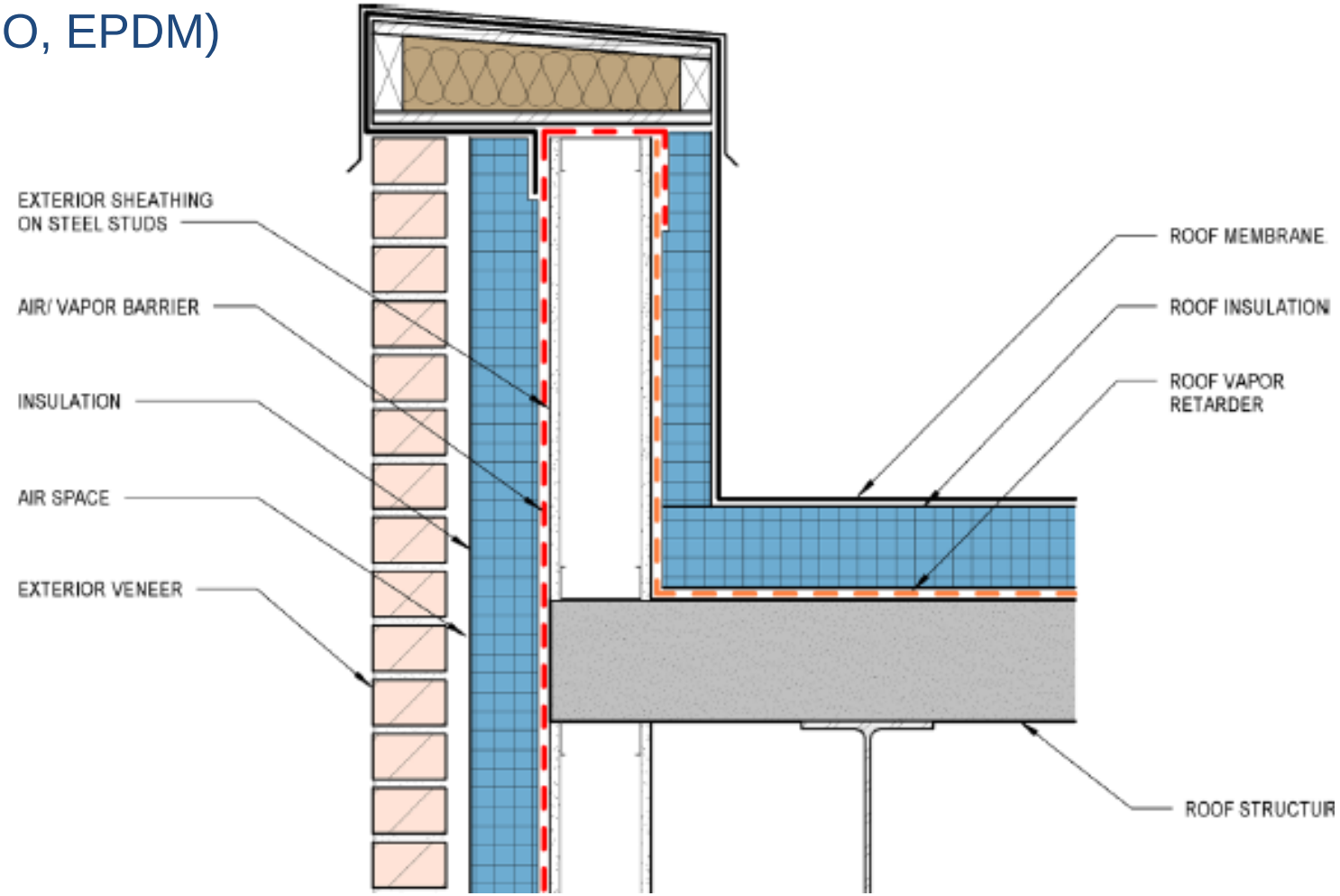


Photo courtesy of Andrew Dunlap, Smith Group

- Single Ply Systems (PVC, TPO, EPDM)

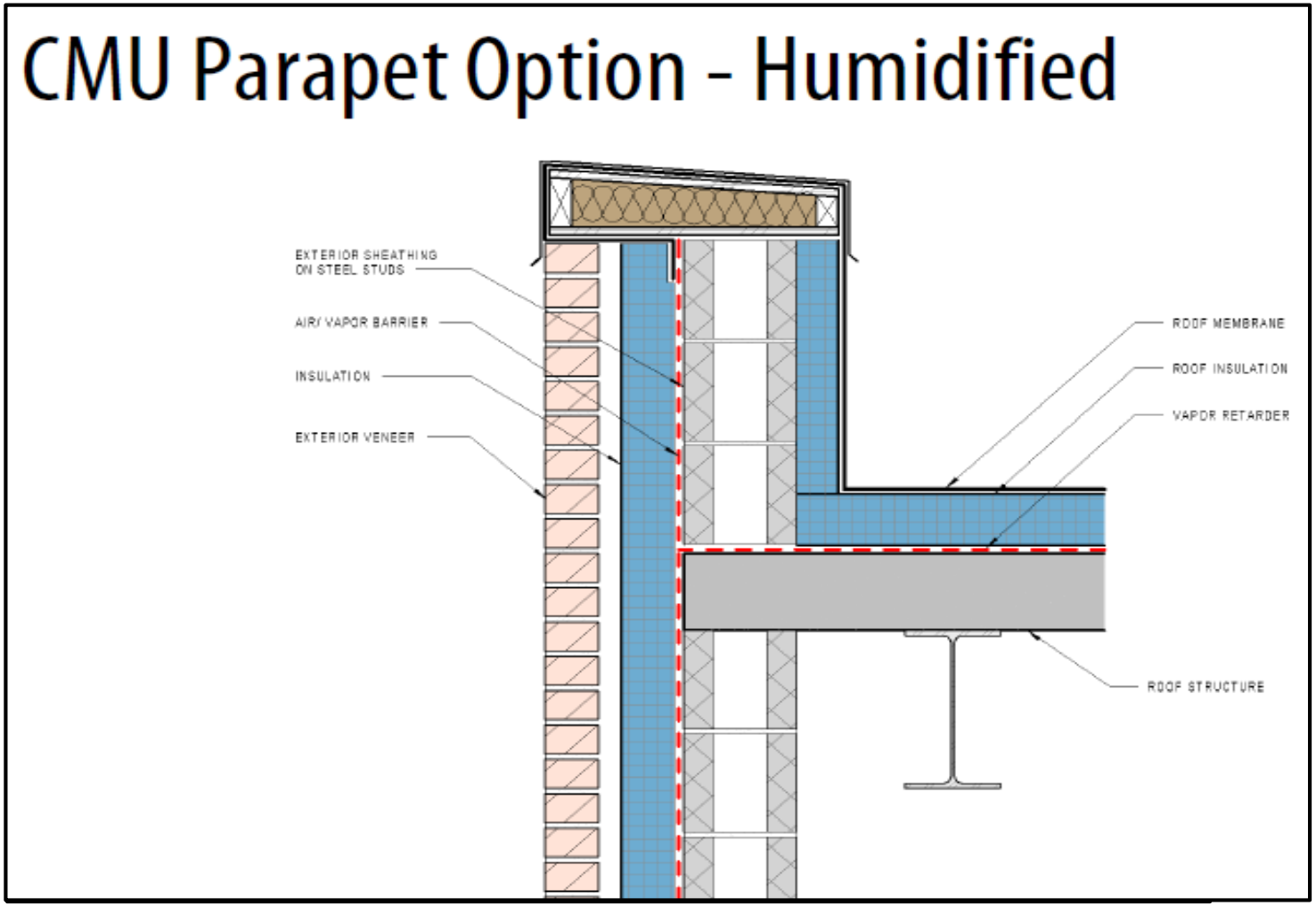


Photo courtesy of Andrew Dunlap, Smith Group

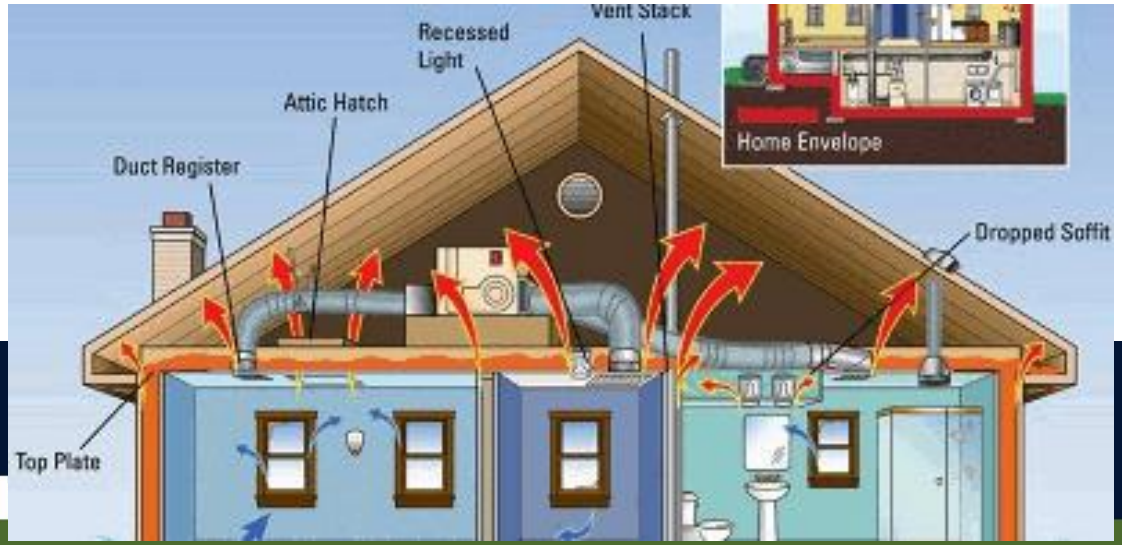
Fluid Applied Membrane Wrapping Over Parapet

CONSIDERATIONS FOR EACH ROOF SYSTEM

- Multi-Ply Systems (BUR, Modified Bitumen, Hot/Cold Fluid Applied)
  - No Compatibility Issues with Asphalts
  - Recommend Getting Letter from Manufacturers
  - Option: Run Oliensis Test

CONSIDERATIONS FOR EACH ROOF SYSTEM

- Steep Slope
  - Connection can be made at Ceiling Level
    - Seal all penetrations through ceiling



CONSIDERATIONS FOR EACH ROOF SYSTEM

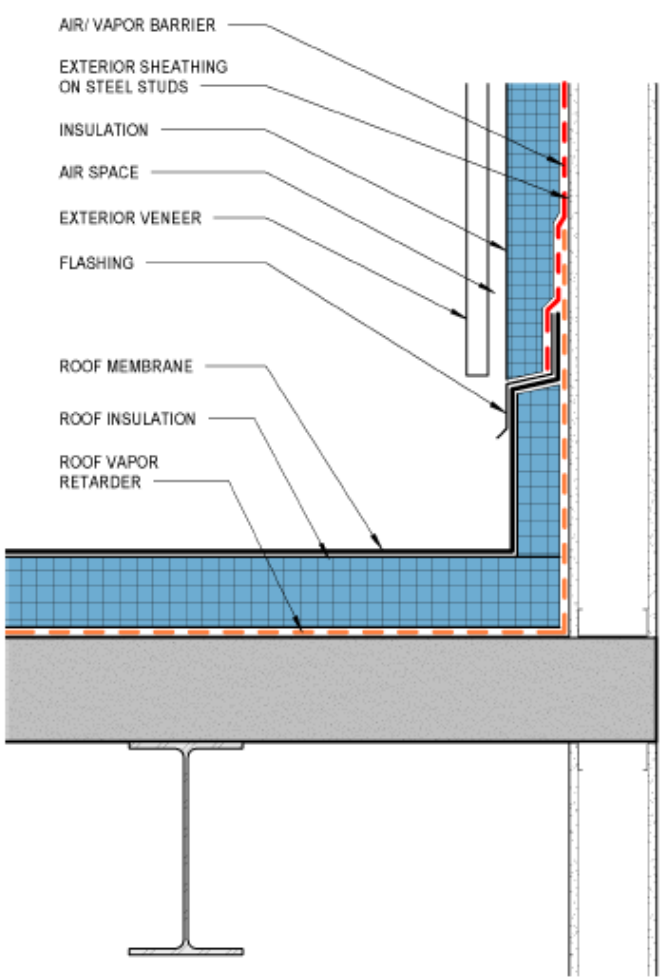
- Sprayed Polyurethane Foam
  - Similar Transition strategy to Single Ply – Make Connection at Roof Deck

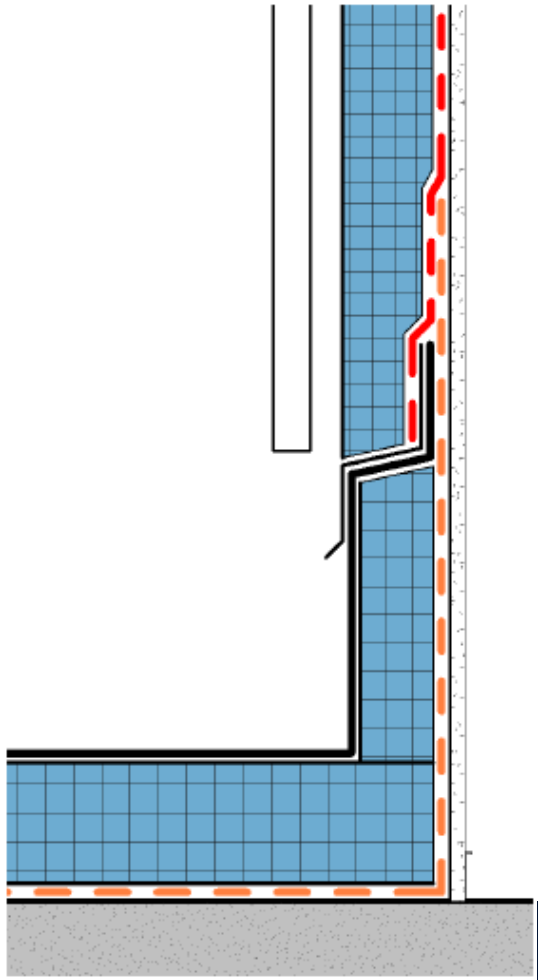
CONSIDERATIONS FOR EACH ROOF SYSTEM

Don’t Forget the Other Roof !

Low Roof / High Wall

Photo courtesy of Andrew Dunlap, Smith Group

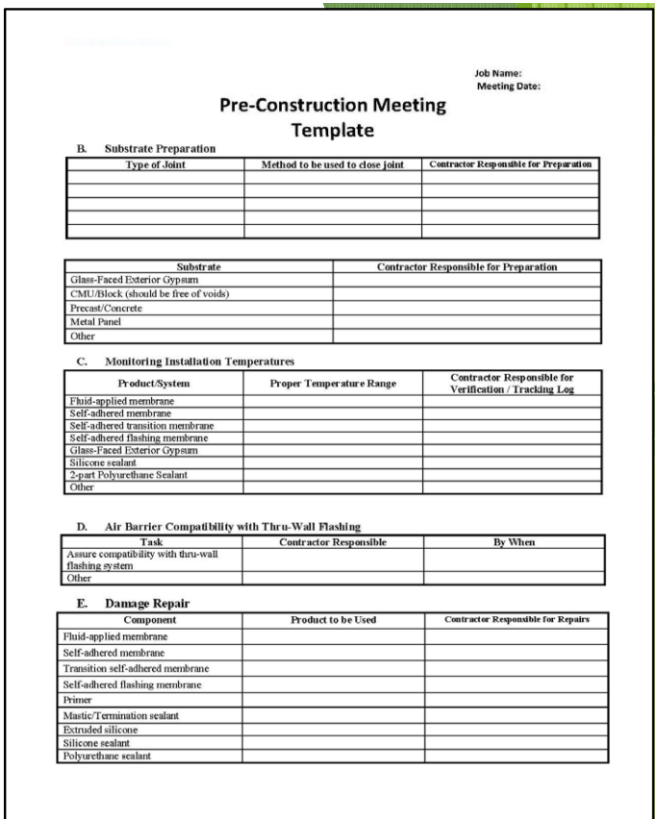




ROOF TO WALL CONNECTION

DETAILING

- Pre-Construction Meetings are Critical
  - Who is Responsible for Connection ?
  - Sequence of Construction
  - Roof First ? Or Wall Air Barrier First ?
  - General Contractor's Responsibilities



Job Name:
Meeting Date:

Pre-Construction Meeting Template

B. Substrate Preparation

Type of Joint	Method to be used to close joint	Contractor Responsible for Preparation

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
Fluid-applied membrane		
Self-adhered membrane		
Transition self-adhered membrane		
Self-adhered flashing membrane		
Primer		
Mastic/Termination sealant		
Extruded silicone		
Silicone sealant		
Polyurethane sealant		

ROOF TO WALL CONNECTION

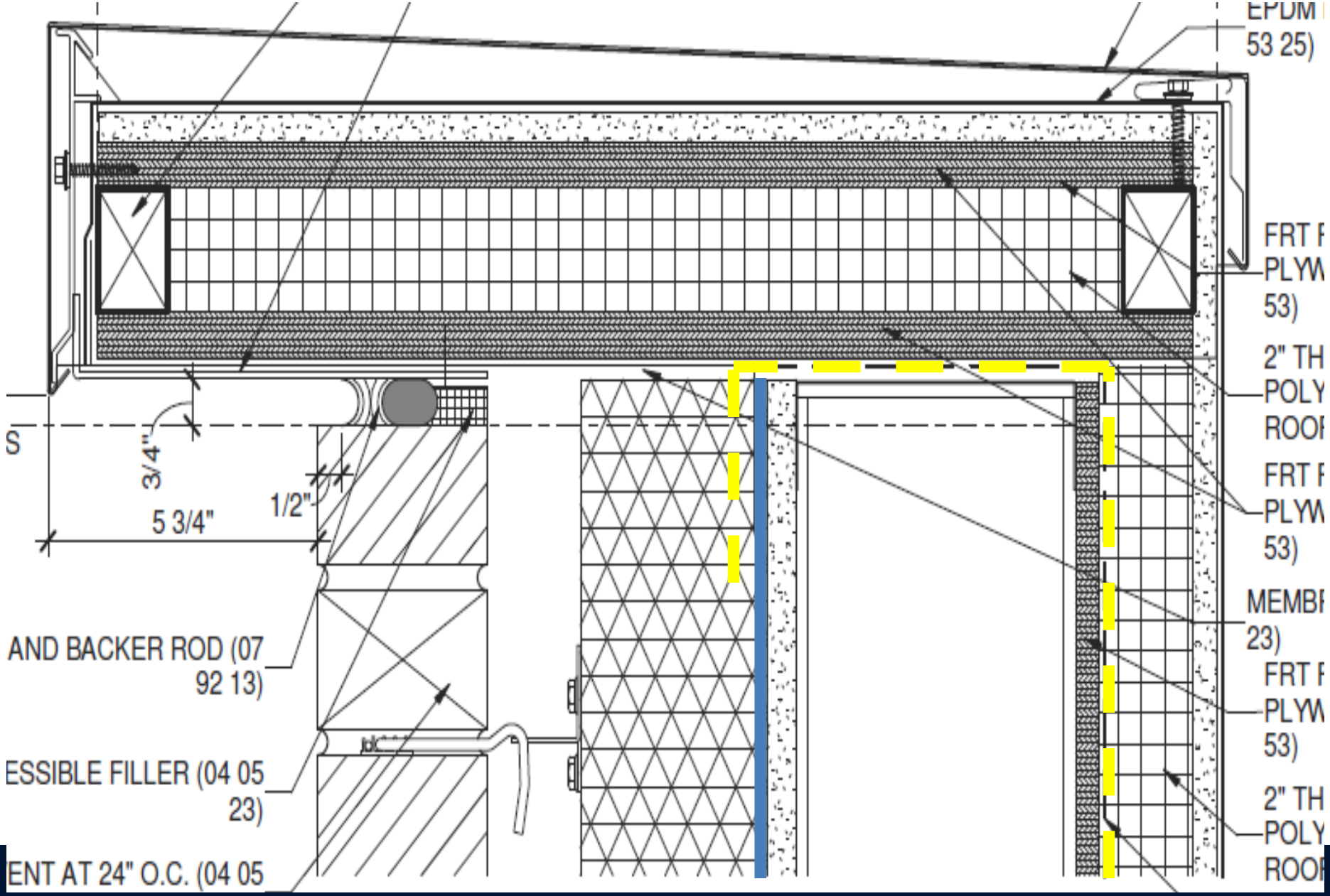
SOME GENERAL GUIDANCE

- Roof Membranes are Water Tight, but Air Leakage Can Still Occur at:
  - Parapet
  - HVAC Curbs
  - Expansion Joints
  - Penetrations

ROOF TO WALL CONNECTION

SOME GENERAL GUIDANCE

- Most Common Location of Air and Water Leaks is the Parapet !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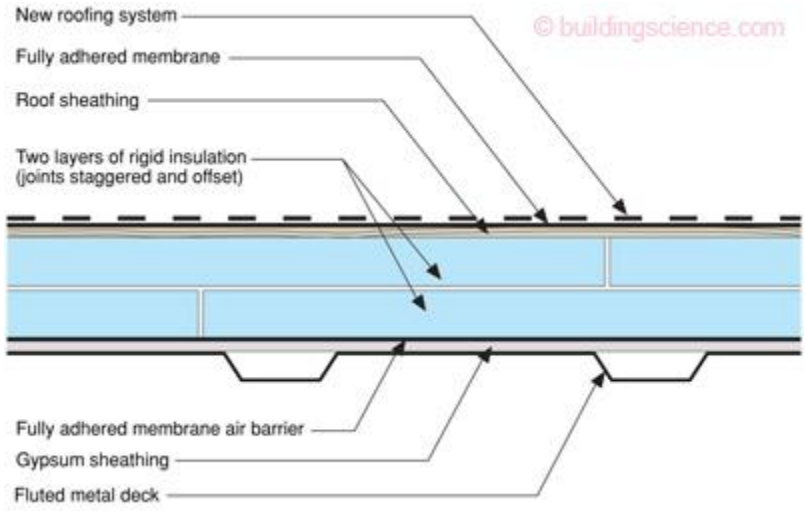
1/2"
5 3/4"
AND BACKER ROD (07
92 13)
ESSIBLE FILLER (04 05
23)
ENT AT 24" O.C. (04 05

ROOF TO WALL CONNECTION

SOME GENERAL 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



ROOF TO WALL CONNECTION

SOME GENERAL GUIDANCE

- Roof 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 a Roof System that has the Air and Vapor Control Layer on the exposed Side can result in a sandwhich for Moisture

ROOF TO WALL CONNECTION

SOME GENERAL GUIDANCE

- So, What or 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 a Membrane installed on the Roof Deck ?

ROOF TO WALL CONNECTION

SOME GENERAL GUIDANCE

Transition of Wall Air Barrier to Underside of Metal Roof Deck

ROOF TO WALL CONNECTION

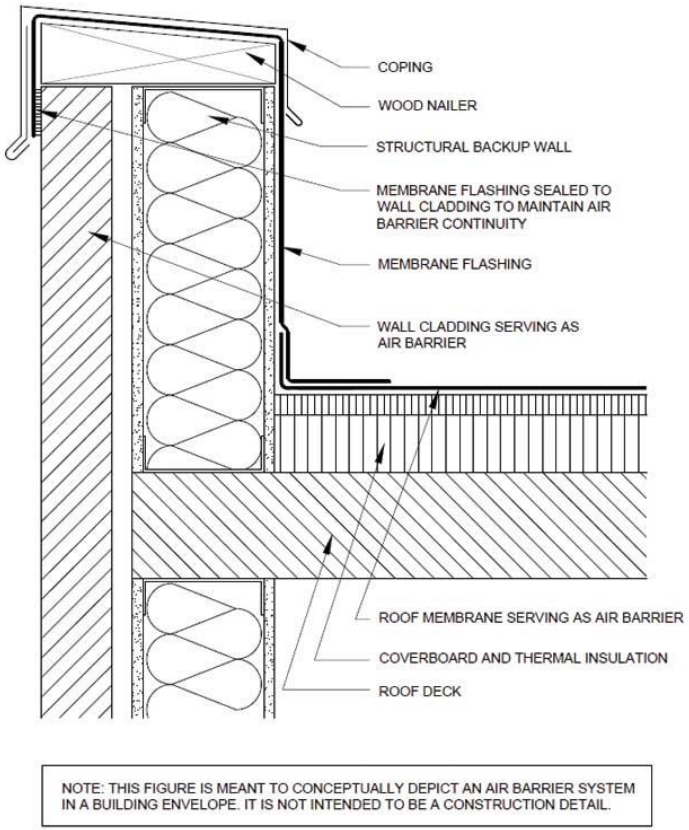
SOME GENERAL GUIDANCE

Transition of Wall Air Barrier onto Concrete Roof Deck

ROOF TO WALL CONNECTION

SOME GENERAL GUIDANCE

- So, What or Where is the Roof Air Barrier ?
  - You need to Identify Clearly in the Construction Drawings what is providing the:
    - Water Control Layer
    - Air Barrier Layer



ROOF TO WALL CONNECTION

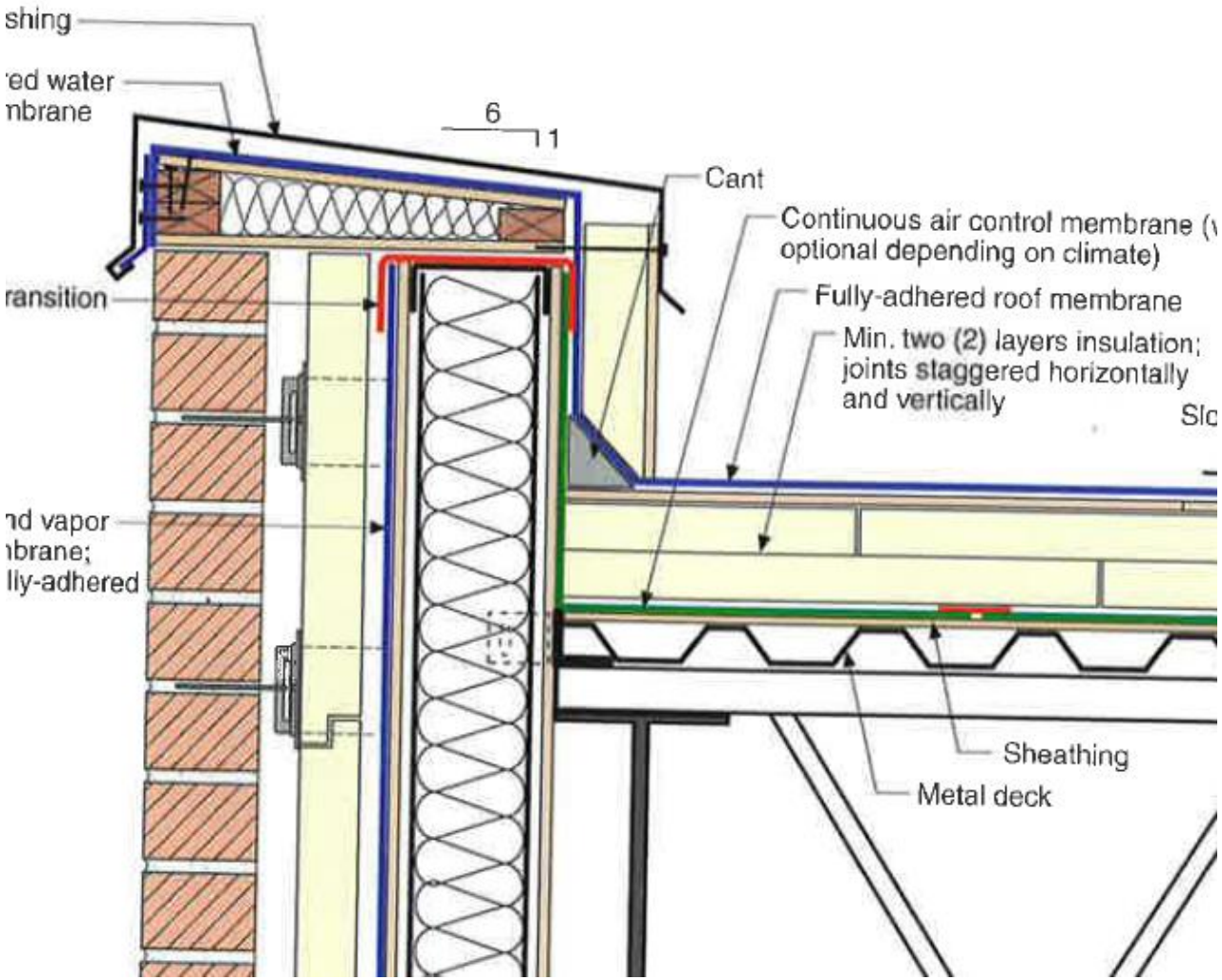
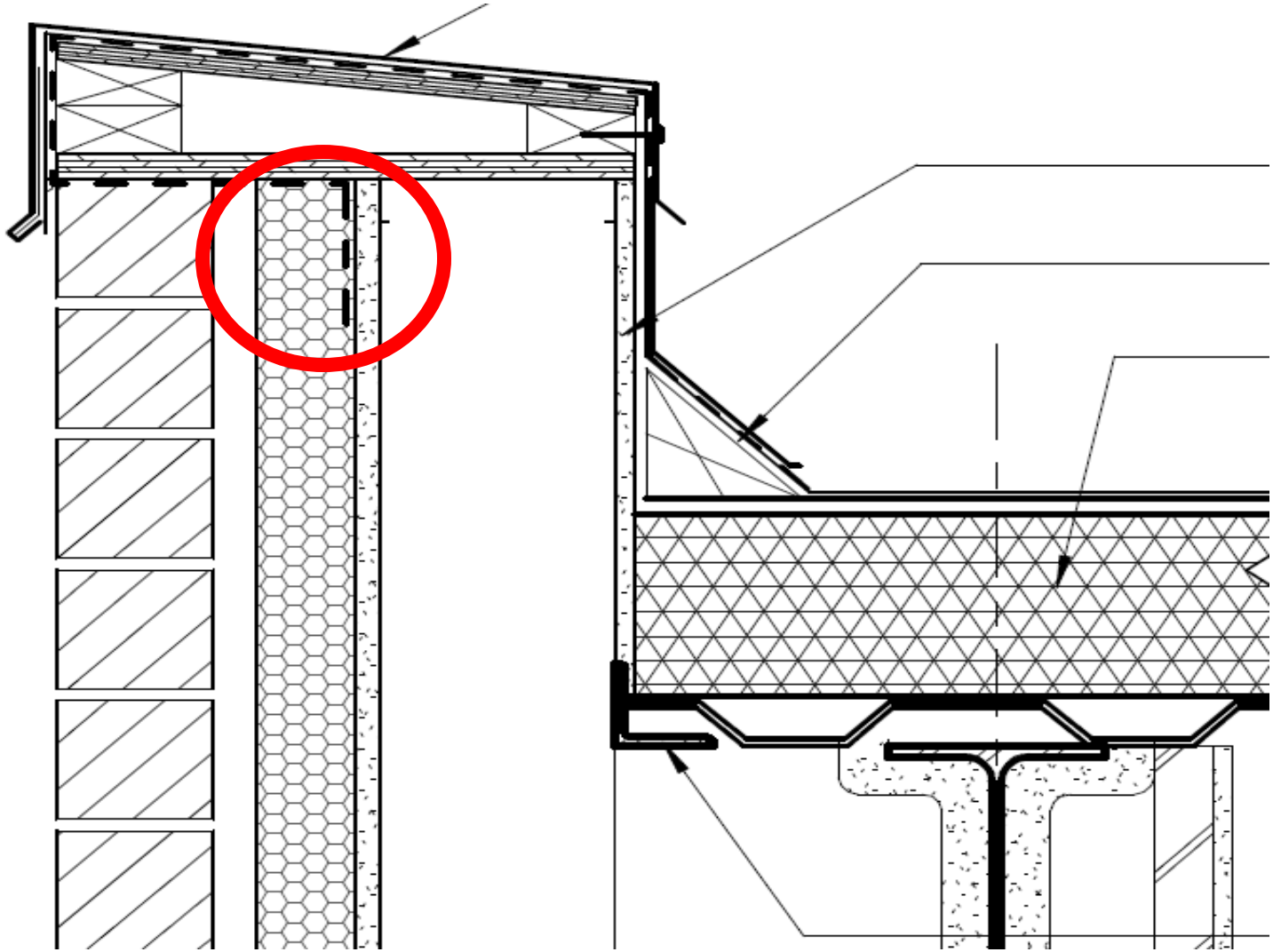
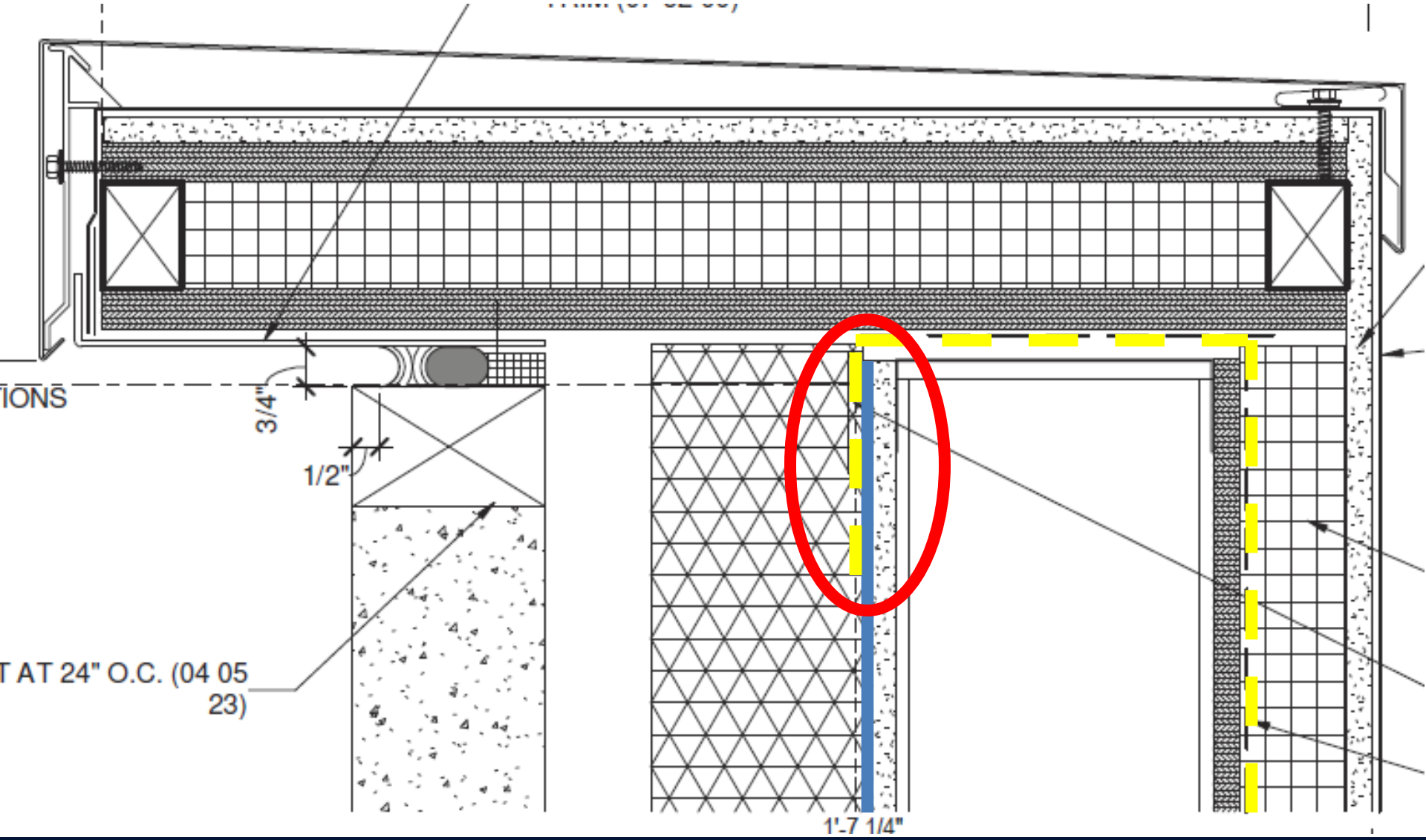


Photo courtesy of John Straube

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3/4"
1/2"
T AT 24" O.C. (04 05
23)
1'-7 1/4"

RESOURCES

Your local ABAA Regional Advocate 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

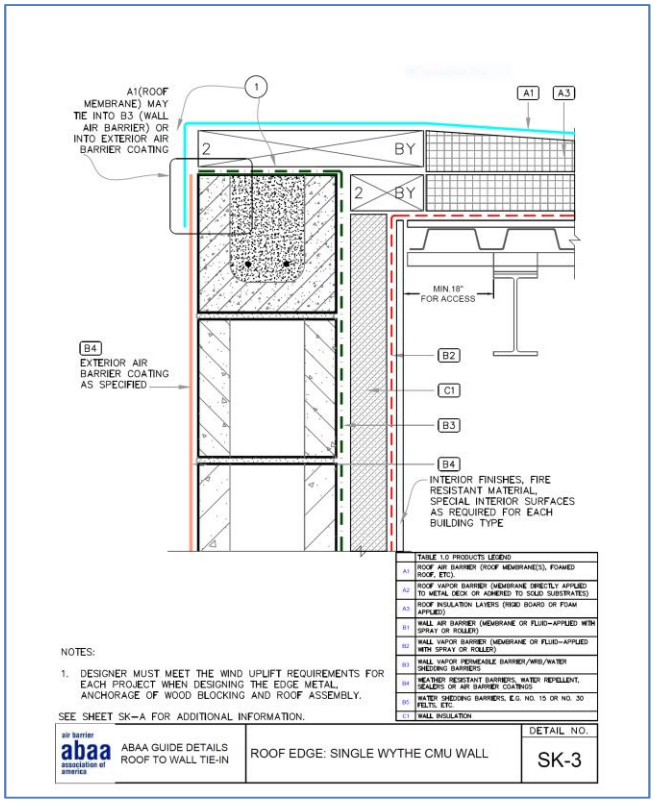
Chemical and adhesive compatibility of materials

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



Add information on the air/water leakage study when available

IN CONCLUSION

AIR BARRIERS

- Roof / Wall Transition needs careful detail in construction drawings.
- Understand Chemical Compatibility between Roofing Membranes and various types of air barriers
- Sequence of Construction is Critical. Identify who is responsible for final connection

IN CONCLUSION

AIR BARRIERS

- Resources:
  - Airbarrier.org (specs, details, technical articles, evaluated materials, accredited contractors, consultants, manufacturers)
  - ABAA presentations (1 hour, ½ day, full day)
  - Annual Air Barrier Conference – March 26th – 28th 2018 Norfolk, Virginia
  - Whole Building Design Guide – wbdg.org
  - Manufacturer's Details

Thank you for your time!

Question and Answer Period

This concludes The American Institute of Architects Continuing Education Systems Course

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