

air barrier

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# Air Barrier Considerations for Roof/Wall Intersections

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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

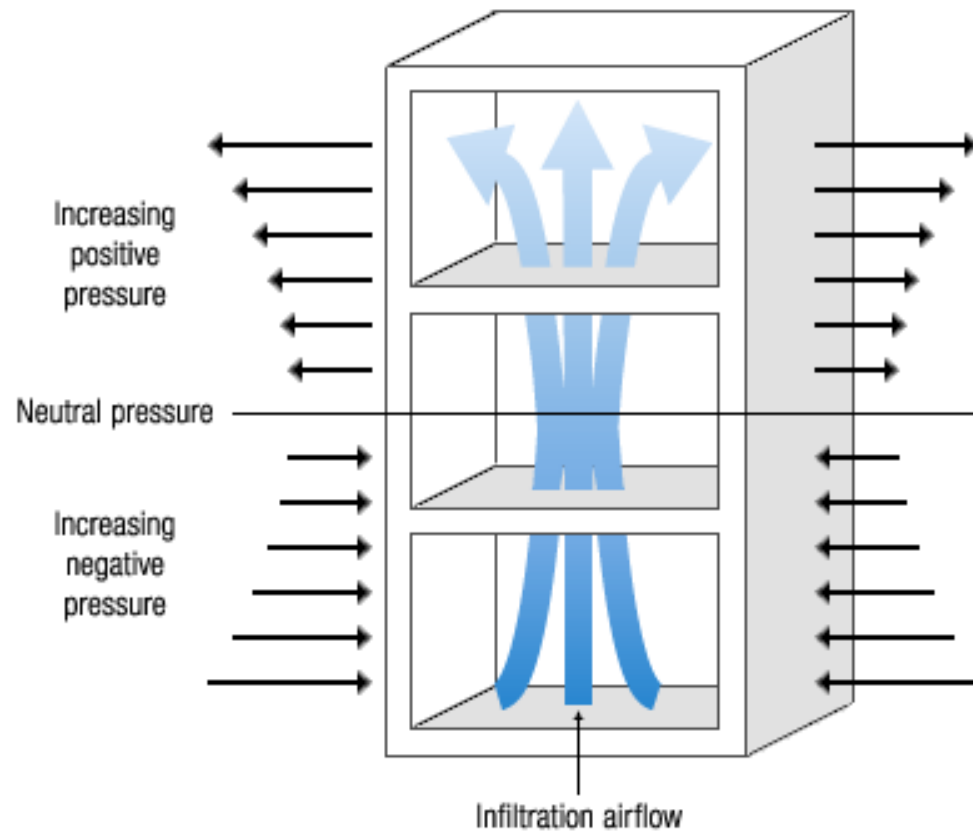
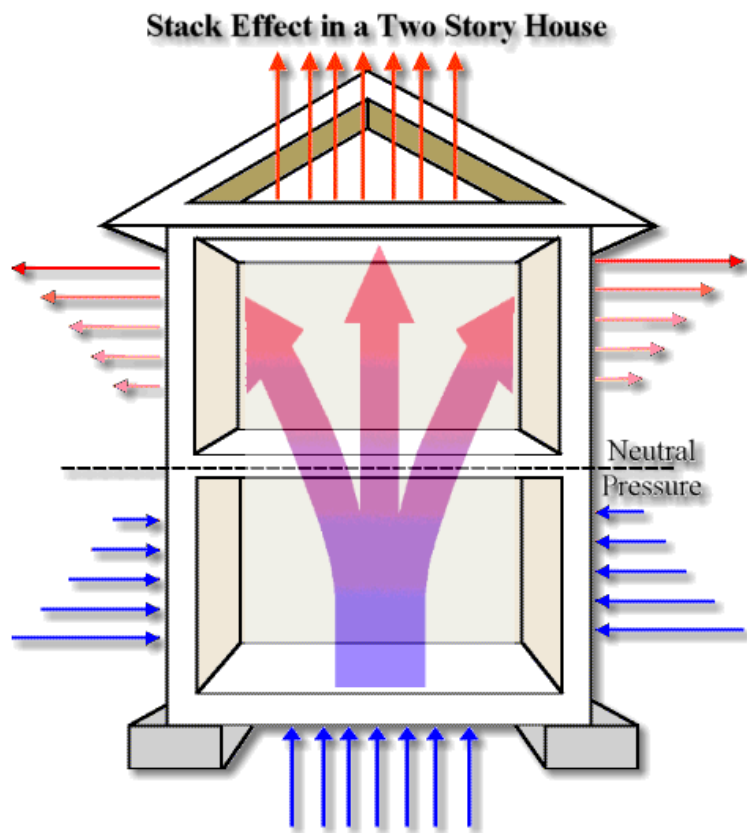
# BUILDING SCIENCE

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

First we need to understand how air flows to understand why the roof/wall connection is important

# BUILDING SCIENCE

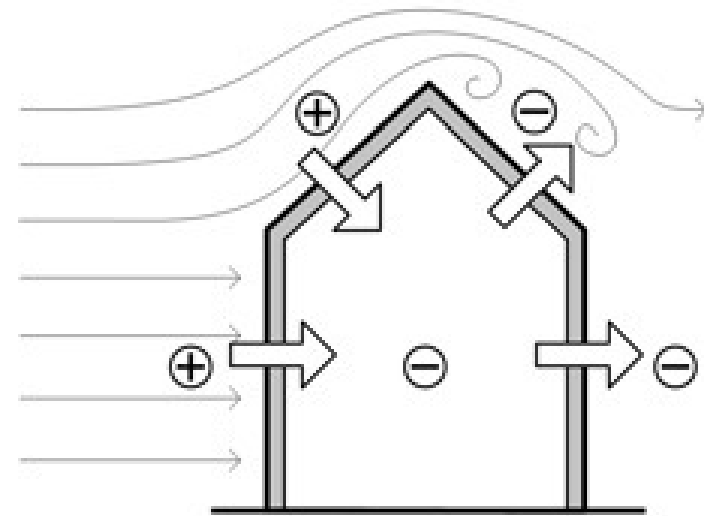
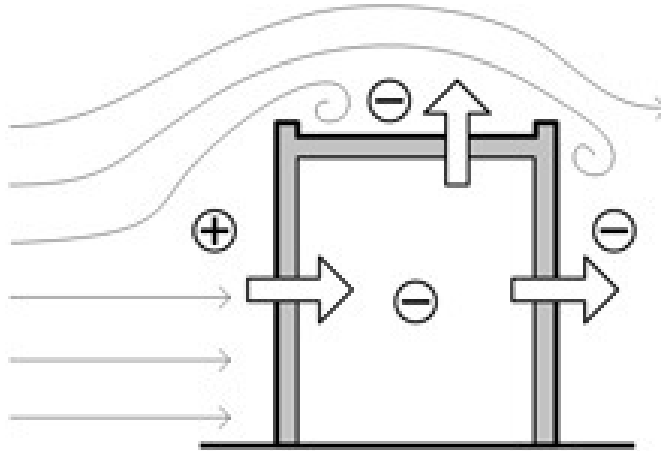
## AIR FLOW – STACK EFFECT



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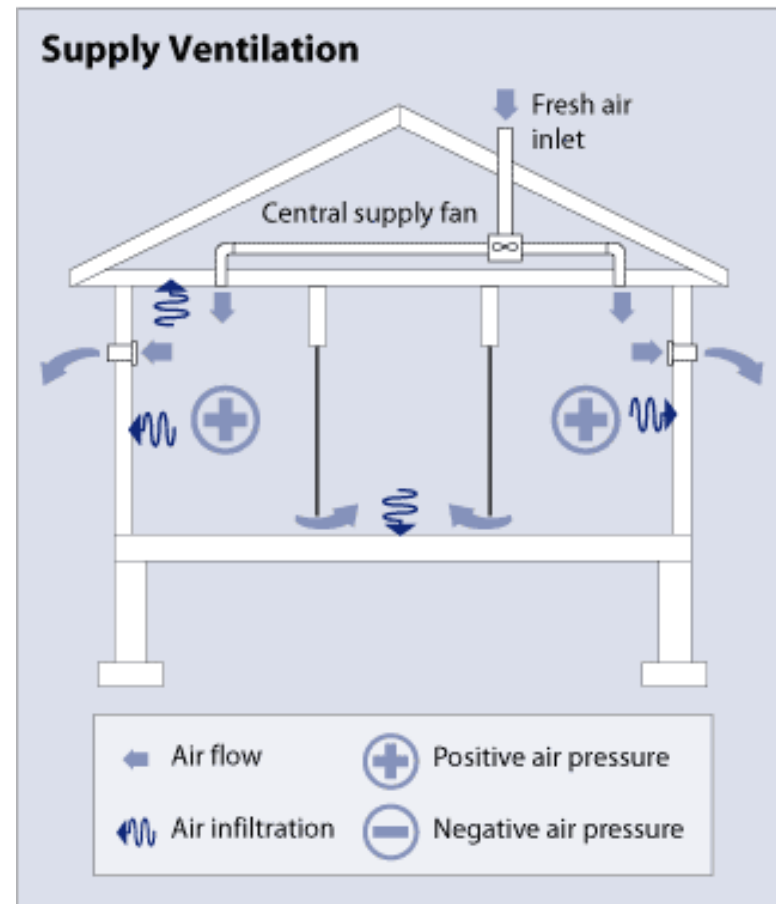
# BUILDING SCIENCE

## AIR FLOW – WIND EFFECT



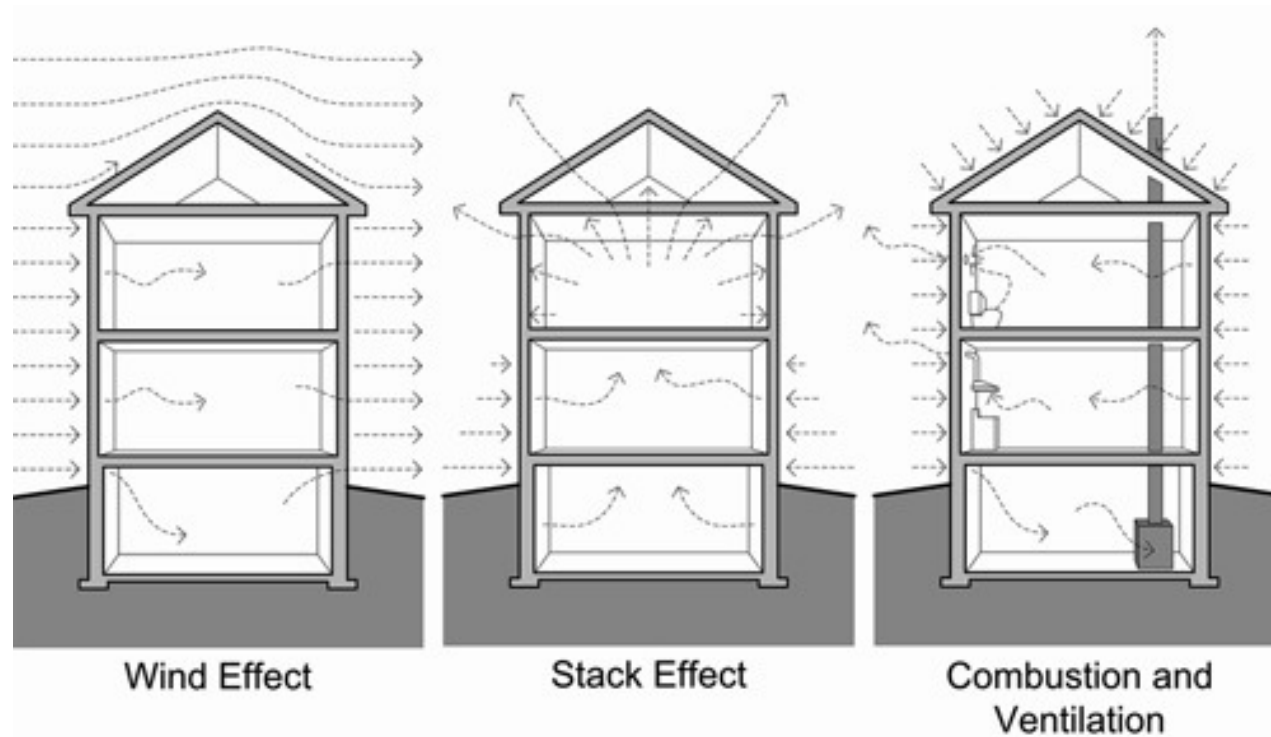
# BUILDING SCIENCE

## AIR FLOW – MECHANICAL EFFECTS



# BUILDING SCIENCE

## AIR FLOW



# 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



# 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

# 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

- ASTM 2178
- 0.004 cfm / ft<sup>2</sup>
- List of 16 materials that are acceptable – *provided joints are sealed and installed as an air barrier*

### Assembly

C402.5.1.2.2

- ASTM 2357, 1677 or 283
- 0.04 cfm / ft<sup>2</sup>
- 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)

### Building Test

C402.4.1.2.3

- ASTM 779
- 0.40 cfm/ft<sup>2</sup>
- Or equivalent method approved by code official

# BUILDING CODES

## INTERNATIONAL ENERGY CONSERVATION CODE

### Material

C402.5.1.2.1

- Roof Materials listed in IECC:
  - Built-Up Roofing Membrane
  - Modified Bituminous Roof Membrane
  - Fully Adhered Single Ply Roof Membrane
  - Sheet Steel

### Assembly

C402.5.1.2.2

- Roof Assemblies listed in IECC:
  - No Assemblies specifically listed, ASTM 2357 is compliance method

# TYPES OF AIR BARRIERS

## MATERIAL CHOICES



# 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

# 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
- How to detail ?
  - PVC: Transition onto Roof Deck (Option 2: Butyl)
  - TPO: Transition onto Roof Deck (Option 2: Butyl)
  - EPDM: Issues with Asphalt

➤ Single Ply Systems  
(PVC, TPO,  
EPDM)

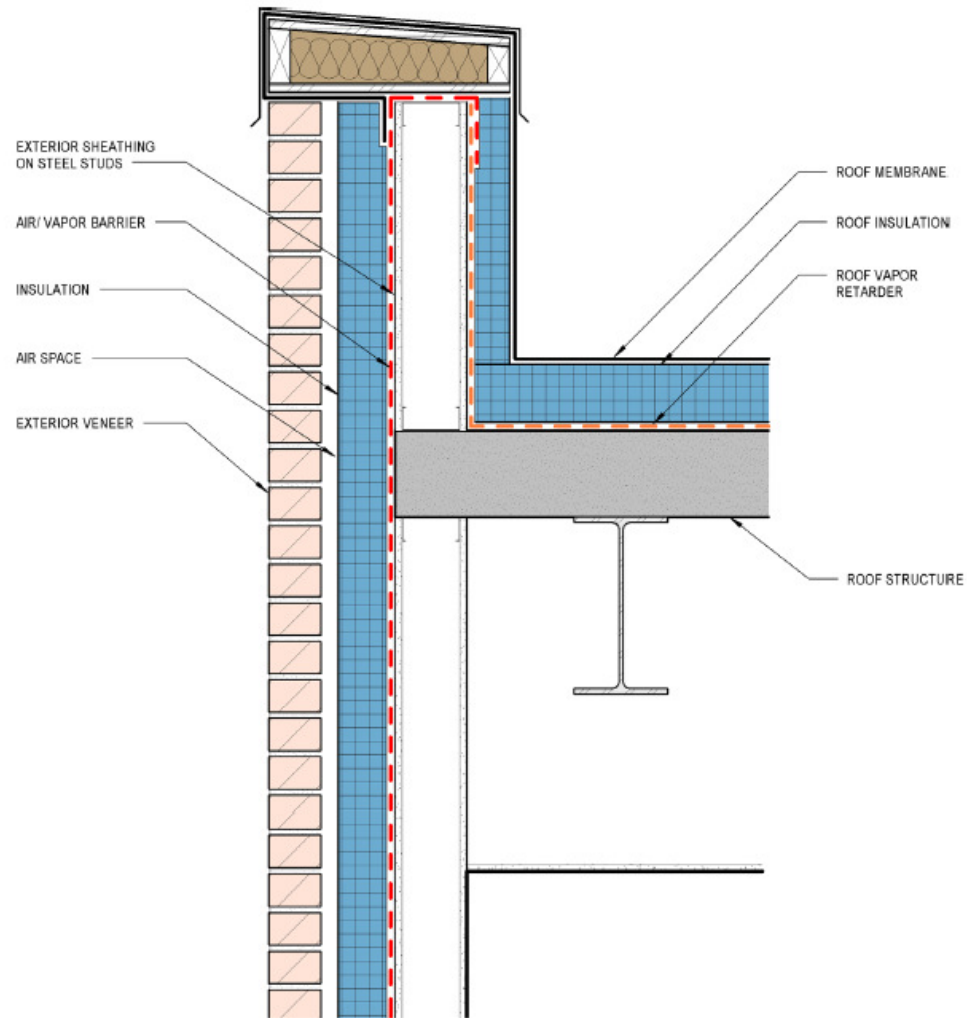


Photo courtesy of Andrew Dunlap, Smith Group

- Single Ply Systems (PVC, TPO, EPDM)

## CMU Parapet Option – Non-Humidified    CMU Parapet Option - Humidified

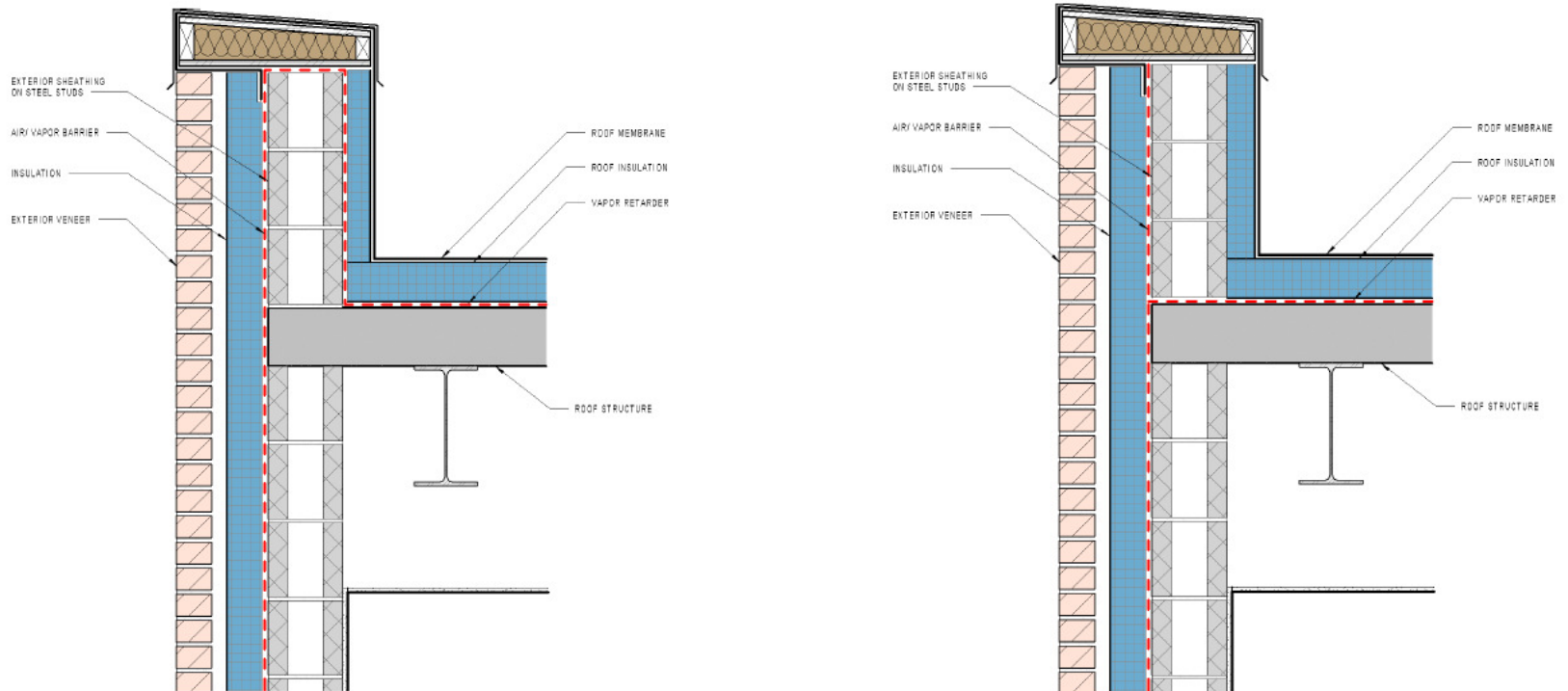


Photo courtesy of Andrew Dunlap, Smith Group

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

- Sprayed Polyurethane Foam



Don't Forget the Other Roof !

# Low Roof / High Wall

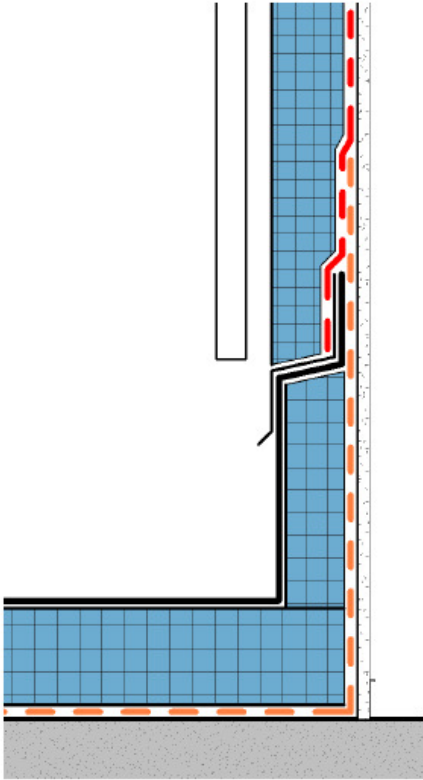
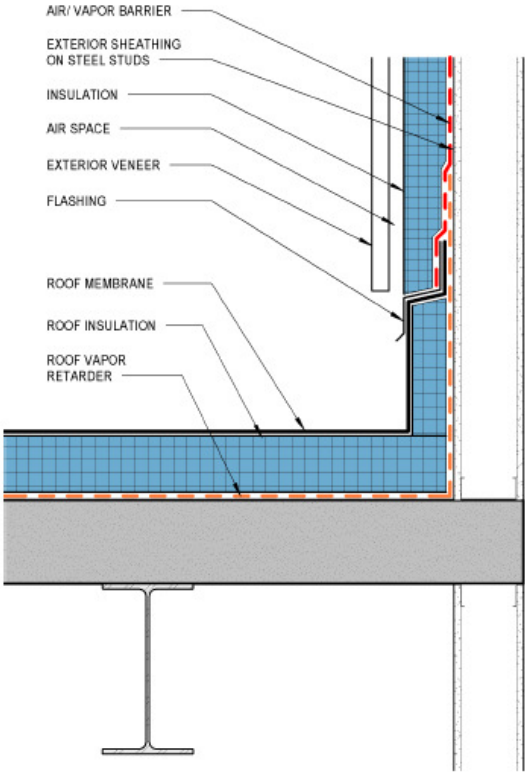


Photo courtesy of Andrew Dunlap, Smith Group

# 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

# 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 !

# ROOF TO WALL CONNECTION

## SOME GENERAL GUIDANCE

- Mechanically Fastened Membranes can billow in the wind and create a pumping action, which can cause condensation
- Make connection to roof deck



# ROOF TO WALL CONNECTION

## SOME GENERAL GUIDANCE

- Many 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 Very Much 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 sandwich 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



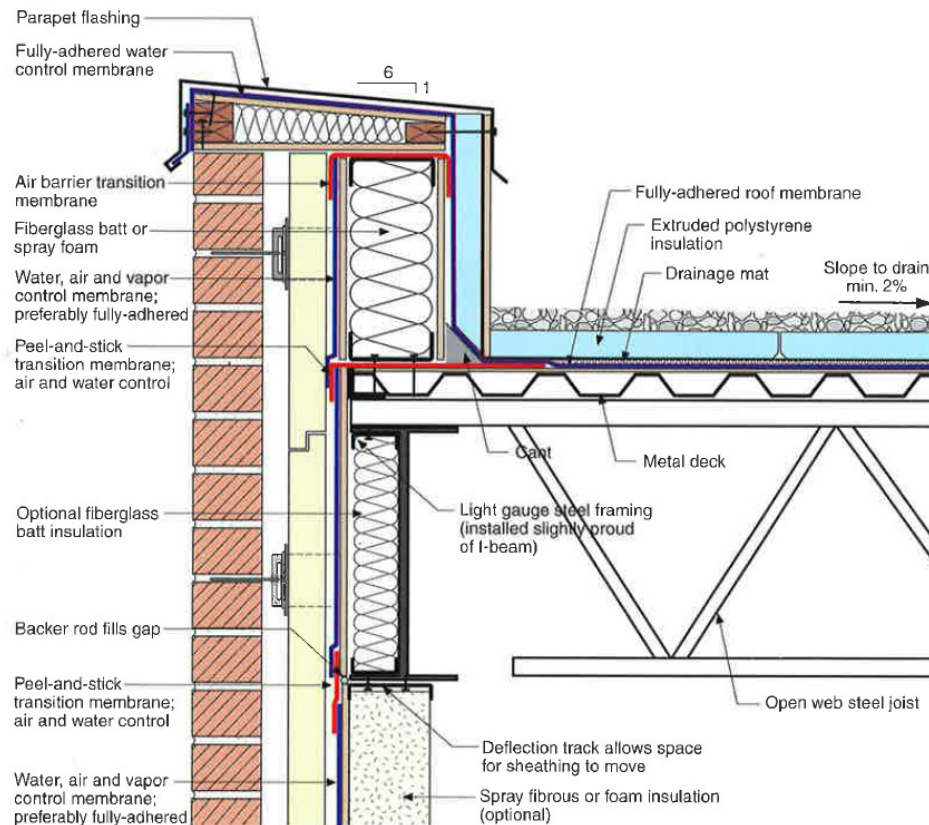
# ROOF TO WALL CONNECTION

## 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

## SOME DETAILS AND PICTURES

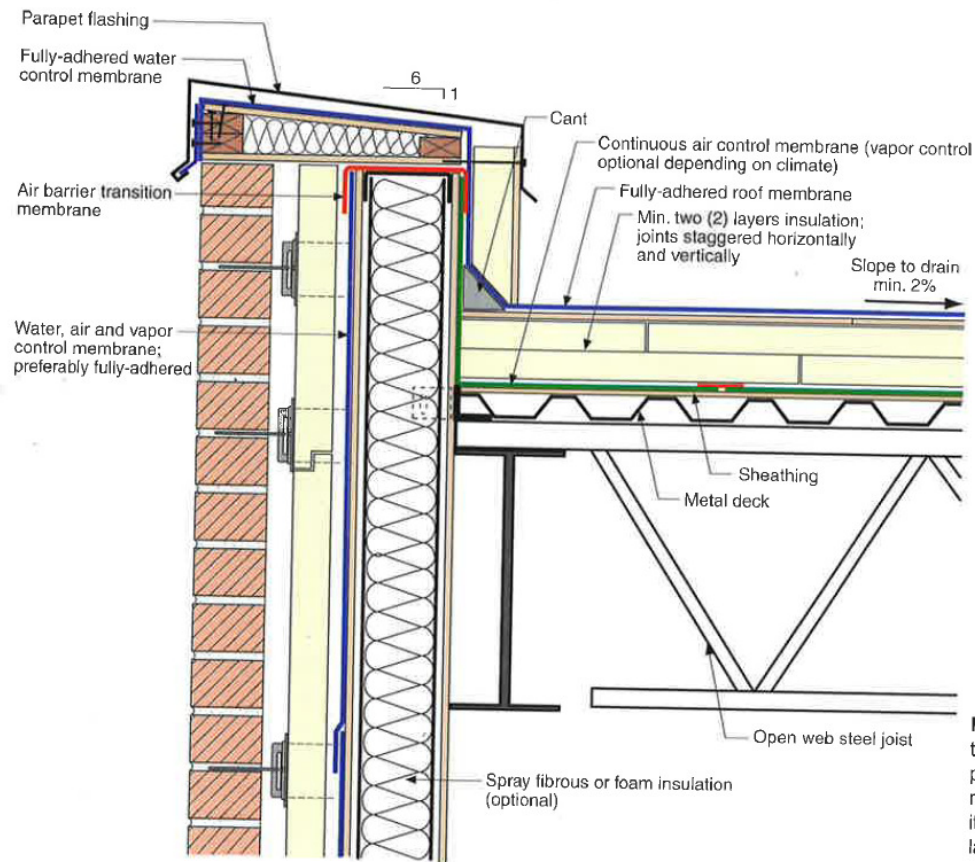


**Figure 5.3:** An inverted roof design allows both the designer and builder to easily ensure continuity of the water, air, and vapor control layers (the fully-adhered roof membrane) while also protecting these layers from extreme environmental conditions.

Photo courtesy of John Straube

# ROOF TO WALL CONNECTION

## SOME DETAILS AND PICTURES



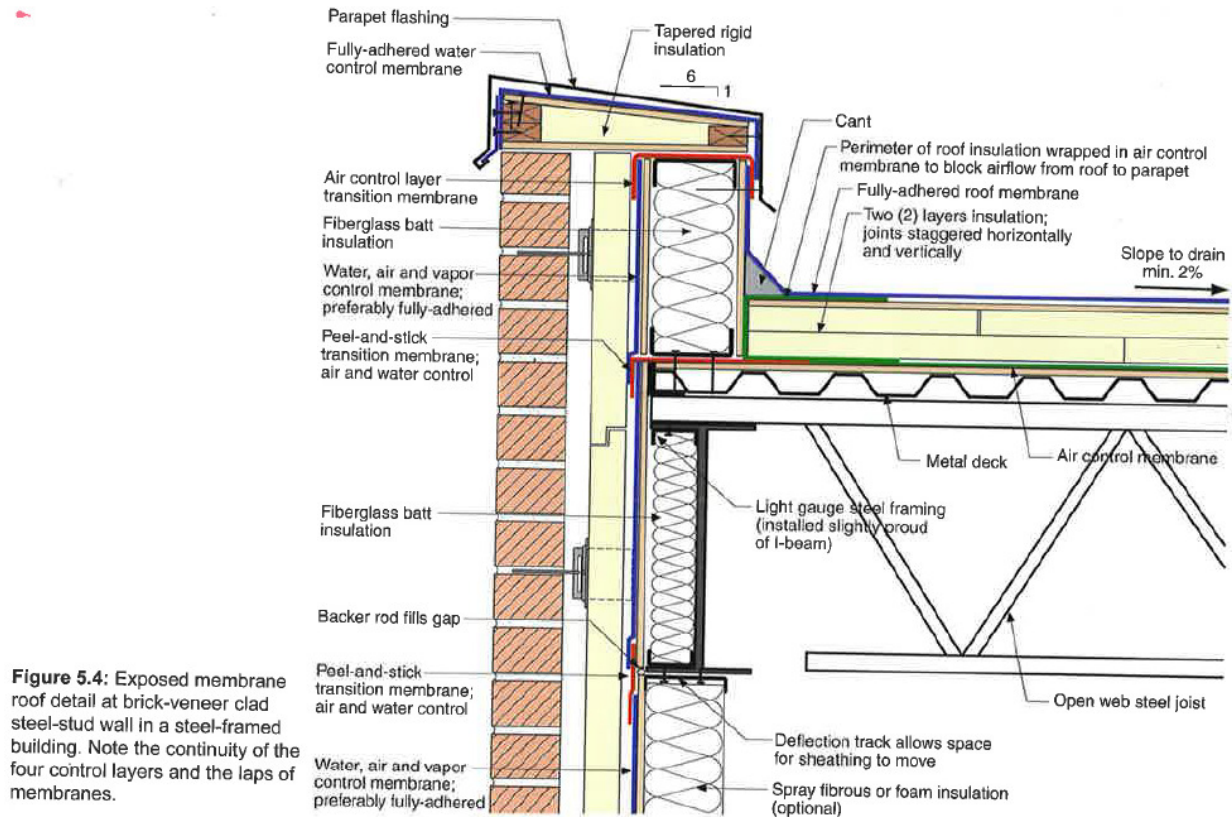
**Figure 5.5:** Extending the structure upward as a cantilevered parapet is possible, but great care must be taken to ensure continuity of the air and thermal control layers.

Photo courtesy of John Straube



# ROOF TO WALL CONNECTION

## SOME DETAILS AND PICTURES



**Figure 5.4:** Exposed membrane roof detail at brick-veneer clad steel-stud wall in a steel-framed building. Note the continuity of the four control layers and the laps of membranes.

Photo courtesy of John Straube

# 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](http://Airbarrier.org) (specs, details, technical articles, evaluated materials, accredited contractors, consultants, manufacturers)
  - ABAA presentations (1 hour, ½ day, full day)
  - Annual Air Barrier Conference – April 2016 in Reston, Virginia
  - Whole Building Design Guide – [wbdg.org](http://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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