

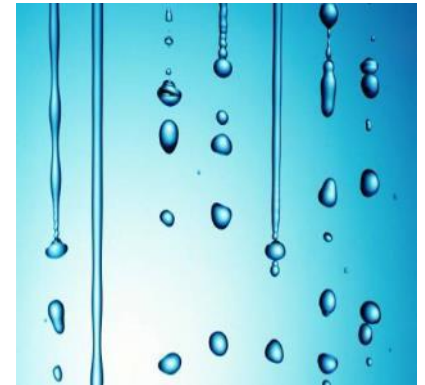


# Evolution of WRBs: selecting the right protection for your project

Date and author details here

# What we do

Henry® products and systems **manage** the flow of **water, air, vapor and energy** through the building envelope, from foundations to roof, improving the structure's energy efficiency, livability and sustainability for the benefit of owner, occupant and the environment.





# Residential and Light Commercial Building Envelope Systems<sup>®</sup>



## North American Leader

- Wall systems
  - Self-adhered and mechanically attached
    - Water-resistive barriers (WRBs)
    - Air barriers
    - Window system flashings
- Self-adhered roofing underlayments
  - For use under shingles, tile, metal, shake, slate and other sloped roofing surfaces
- Foundation systems
  - Below grade walls, foundation vapor barriers and drainage boards

# Residential and Light Commercial Building Envelope Systems®

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# **Learning objectives**

# Learning objectives

## **Understand weather-resistive barrier evolution and design options for residential and light commercial projects**

- Learn industry definitions
- Review exterior wall evolution
- Understand evolution of forces that impact walls
- Identify weather-resistive barrier systems and components
- Highlight specification, design and material selection influences

# Industry definitions

# Learn industry definitions

## Industry definitions

- Air barrier:
  - Systems of materials designed and constructed to control airflow between a conditioned space and an unconditioned space
- Water-resistive barrier (WRB):
  - Material installed onto a substrate, behind the exterior wall veneer, to provide a continuous barrier to resist water
- Vapor barrier/vapor retarder:
  - An element that is designed and installed in an assembly to retard the migration of water vapor

Sources:  
International Building Code  
International Energy Conservation Code  
Building Science Corporation



# Exterior wall evolution

# Review exterior wall evolution

## Early walls

- Protection from the weather
  - Local materials
    - Wood framing
    - Mass masonry
  - Dried quickly
  - Durable
- Consequences
  - Drafty
  - Damp
  - High energy

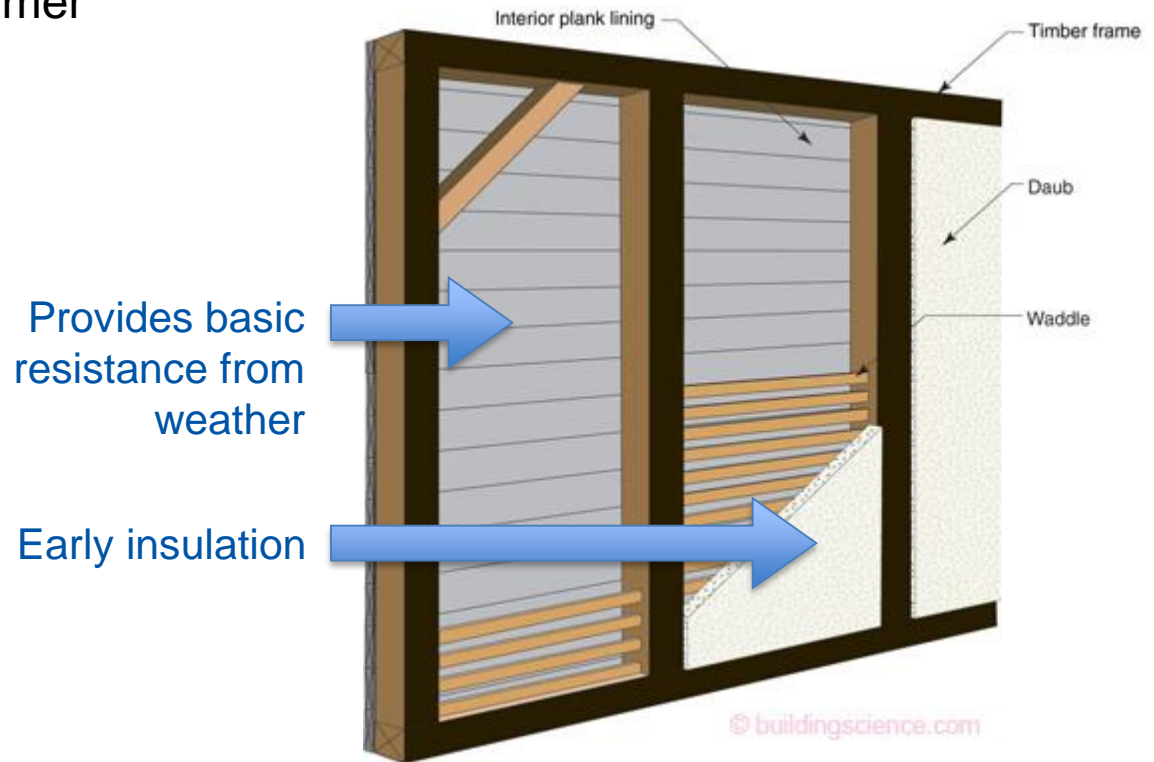


Source:  
Special Collections and Archives, Indiana University of Pennsylvania

# Review exterior wall evolution

## Increased demand for occupant comfort

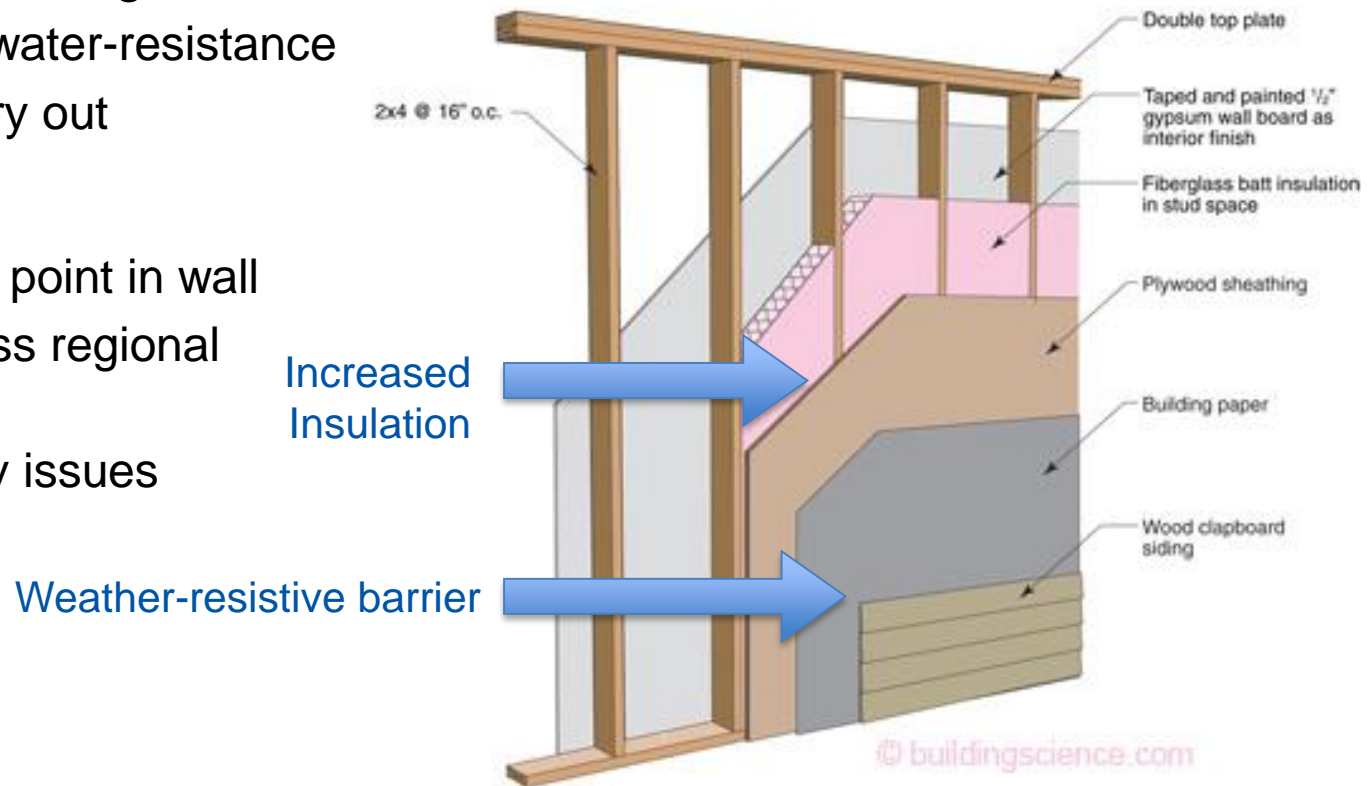
- Higher demand for thermal insulation
  - Keeps warm in winter
  - Keeps heat out during summer
- Consequences
  - Wall cavities got colder reducing drying potential
  - Insulation not performing to expectations
  - Condensation becomes an issue



# Review exterior wall evolution

## Stopping the water and minimal code requirements

- Increased use of insulation
- Improved water management
  - Increased bulk water-resistance
  - Allow walls to dry out
- Consequences:
  - Can create dew point in wall
  - Does not address regional climate cycles
  - Mold / air quality issues



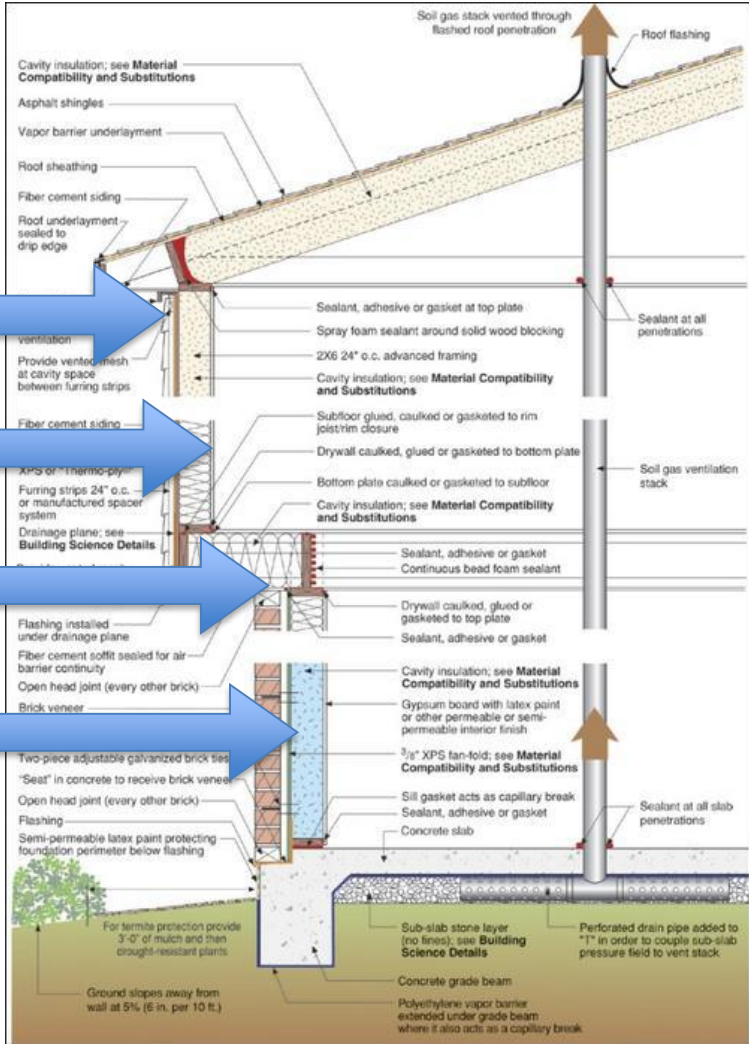
# Review exterior wall evolution

## Modern day

- Building envelope system
  - Energy savings
  - Wall durability
  - Air quality
- Consequences
  - We now have complexity

Insulation Placement  
 Permeability  
 Structural Design  
 Compatibility

Other Considerations  
 Dew Point Calculation  
 Mechanical Systems



# **Evolution of forces that impact walls**



# Evolution of forces that impact walls

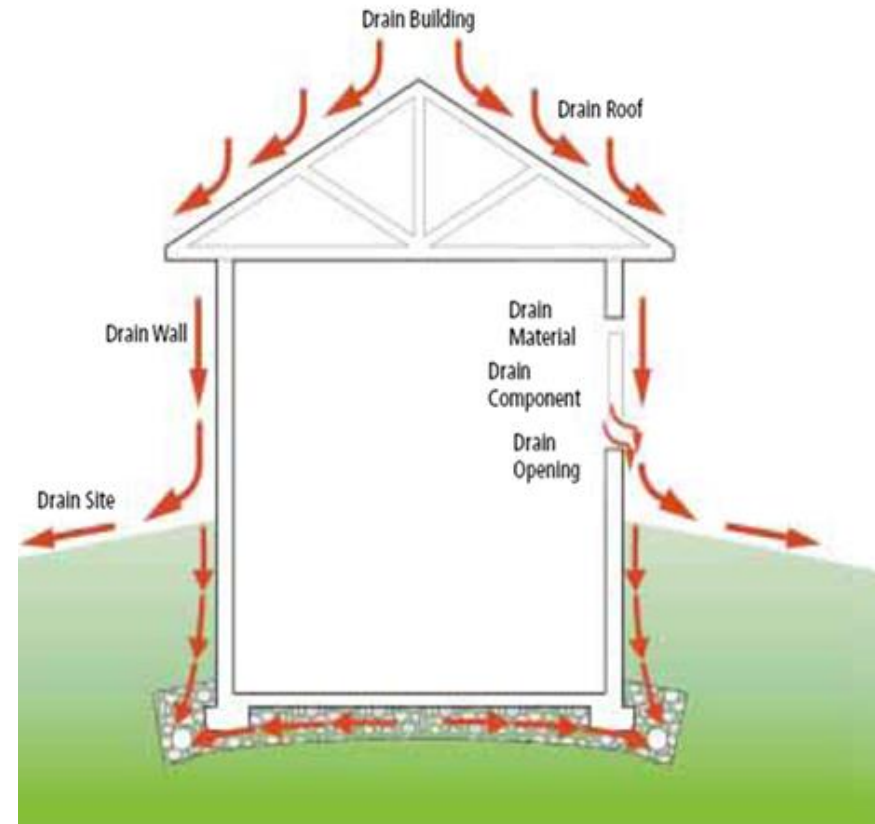


# Evolution of forces that impact walls

## Manage bulk water

### First priority is weather-resistance!

- Bulk water
  - Install materials that resist water absorption
- Drainage
  - Install components to quickly drain bulk water away from the building
- Drying
  - Install a system that dries quickly when exposed to bulk water



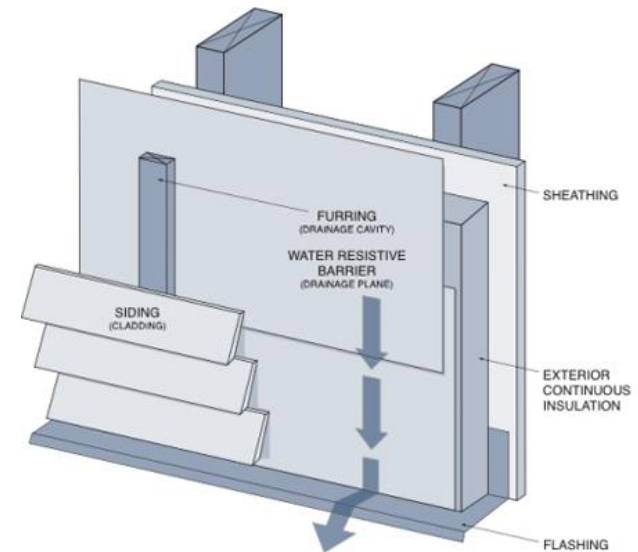
Source: Building Science Corporation  
Article: "Bulk Water Control Methods for Foundations"

# Evolution of forces that impact walls

## Manage bulk water

### First priority is weather-resistance!

- Material choice
  - Choose materials that suit the building type and region
- Correct installation
  - Shed water by layering materials in shingle fashion to direct water down and out
- Critical details
  - Window/door openings, transitions and penetrations



Source: Whole Building Design Guide  
Moisture management strategies

# Evolution of forces that impact walls

## Maximize thermal resistance

### Increased use of insulation

- Provides protection against heat transfer
- Considerations
  - Internal or external placement
  - Type of insulation
  - Hybrid insulation systems
  - Impact on dew point location in wall
  - Required r-value or u-value
  - Resistance to moisture
  - Resistance to wind-washing



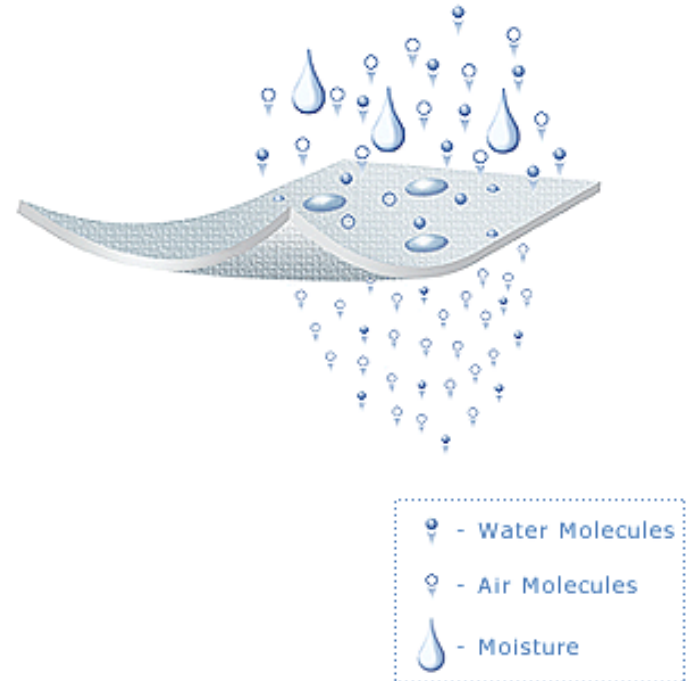
Source: Building Science Corporation

# Evolution of forces that impact walls

## Allow wall assemblies to dry

### Don't trap moisture!

- Select a WRB that promotes drying
  - Vapor permeable membranes
    - Permits the passage of moisture vapor
    - Allows wall assembly to dry
    - Perm rating:  $\geq 5$  perms
    - Typical uses
      - Residential and light commercial WRBs installed on exterior sheathing
  - Non-vapor permeable membranes
    - Typically not installed on residential and light commercial construction



Sources:

Definitions: 2018 International Residential Code

Image: R&A University Article: "You need to know about water perm vapor transmission"

# Evolution of forces that impact walls

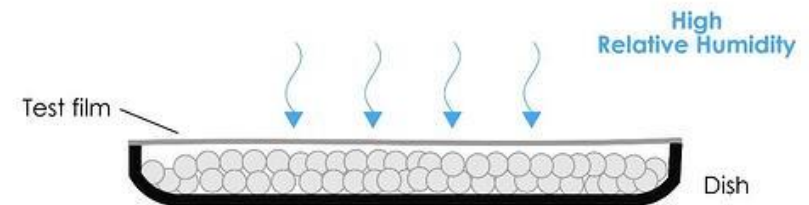
## Allow wall assemblies to dry

### Don't trap moisture!

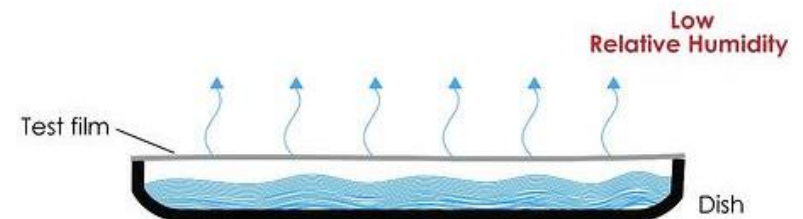
- Industry recognized standards
  - Test methods
    - ASTM E96 Standard Test Methods For Water Vapor Transmission Of Materials
      - Method A: Desiccant method (dry cup)
        - » Test method required per ICC-ES AC38
      - Method B: Water method (wet cup)

### ASTM E96

#### Method A: Desiccant method



#### Method B: Water method



Source: Transshield

Article: "What is water vapor transmission rate?"



# Evolution of forces that impact walls

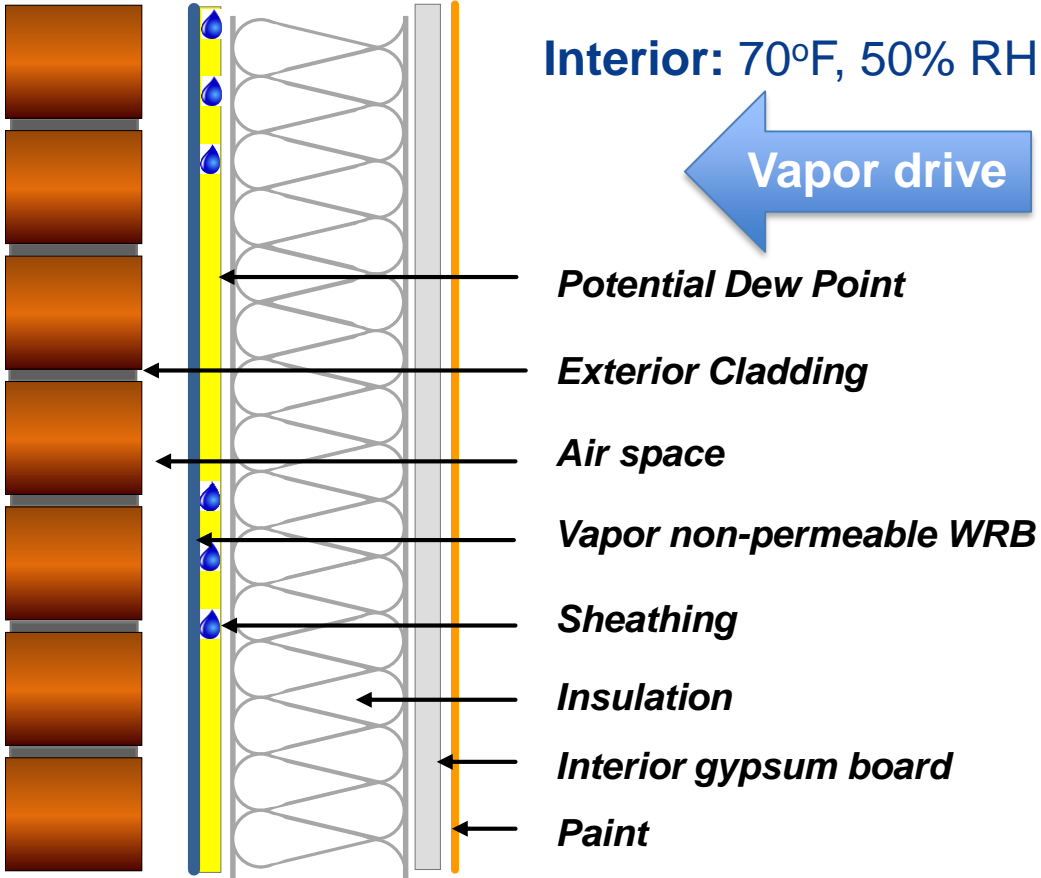
## Allow wall assemblies to dry

**Don't trap moisture!**

**Exterior: 0°F, 10% RH**

**Non-vapor permeable WRBs trap moisture!**

**Non-vapor permeable WRBs installed on exterior sheathing**  
Vapor drive may trap condensation at exterior sheathing and insulation in cold/winter climates



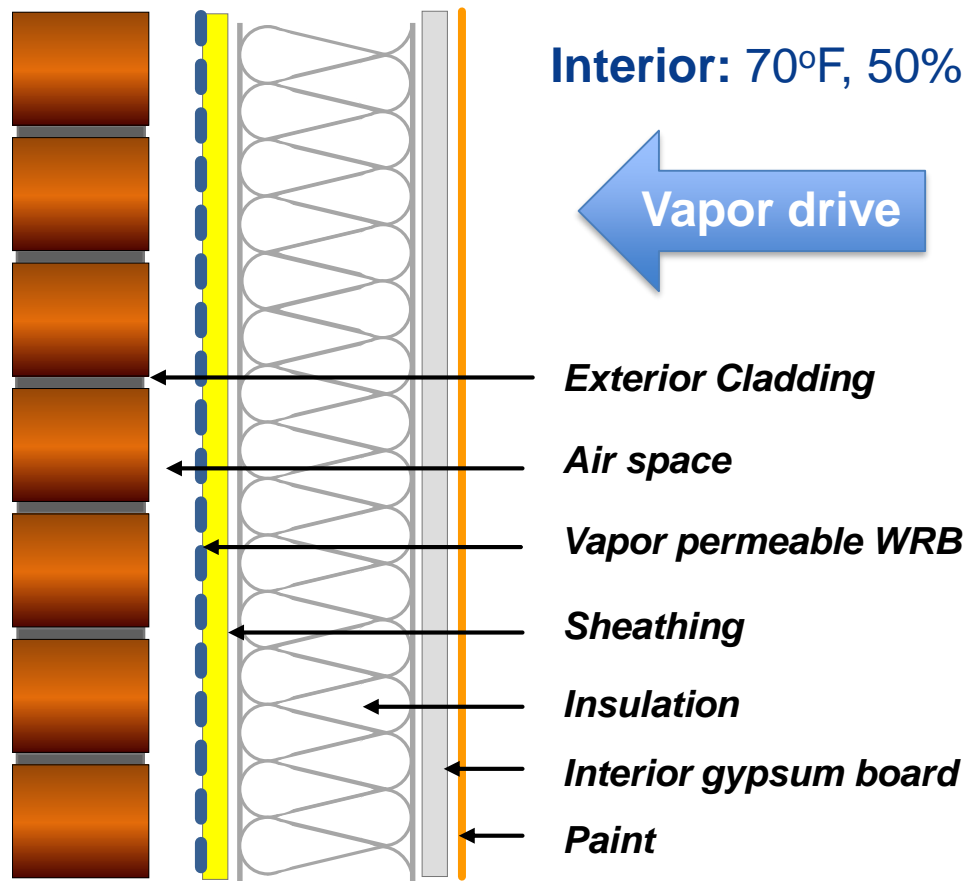
# Evolution of forces that impact walls

## Allow wall assemblies to dry

Don't trap moisture!

Exterior: 0°F, 10% RH

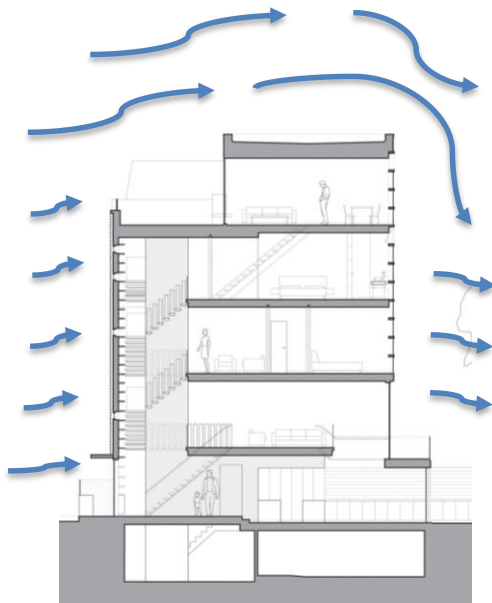
**Vapor permeable WRBs installed on exterior sheathing**  
Allows wall assemblies to dry in all climates



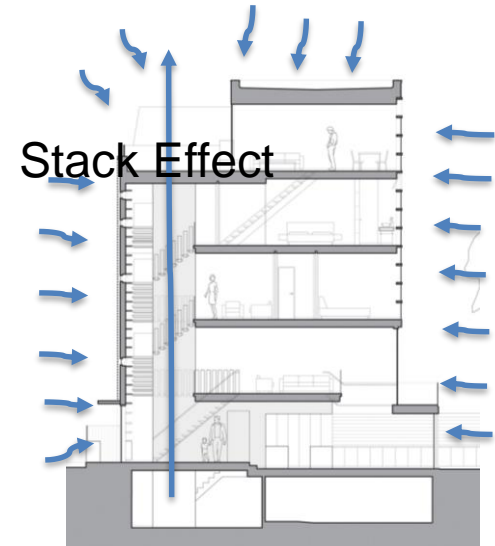
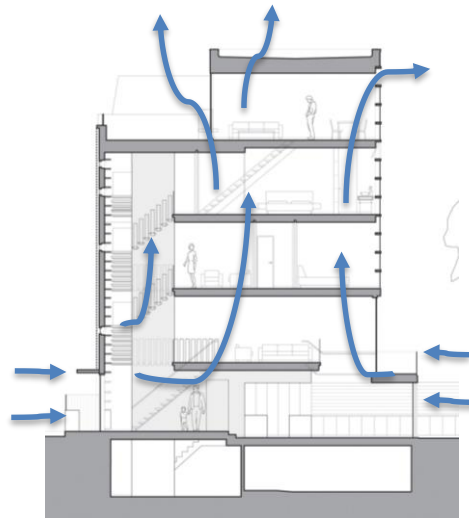
# Evolution of forces that impact walls

## Resist air leakage

Stop uncontrolled air movement!



Wind Effect



Combustion and Ventilation

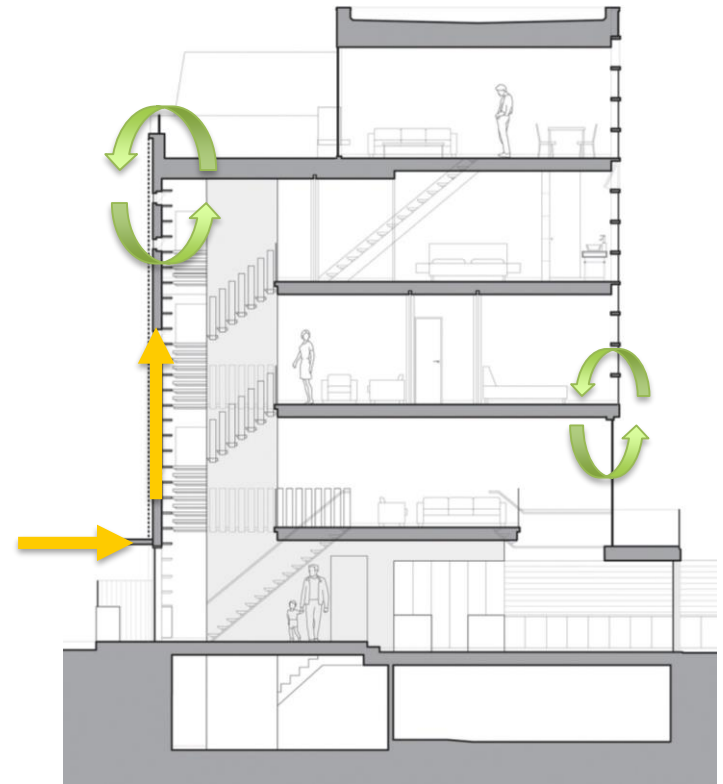
Source: Archdaily  
Architect: GLUCK, Urban Town House

# Evolution of forces that impact walls

## Resist air leakage

### Stop uncontrolled air movement!

- Convective loops
  - Air movement around insulation causes a decrease in thermal resistance
- Wind washing
  - Air movement through insulation causes a decrease in thermal resistance



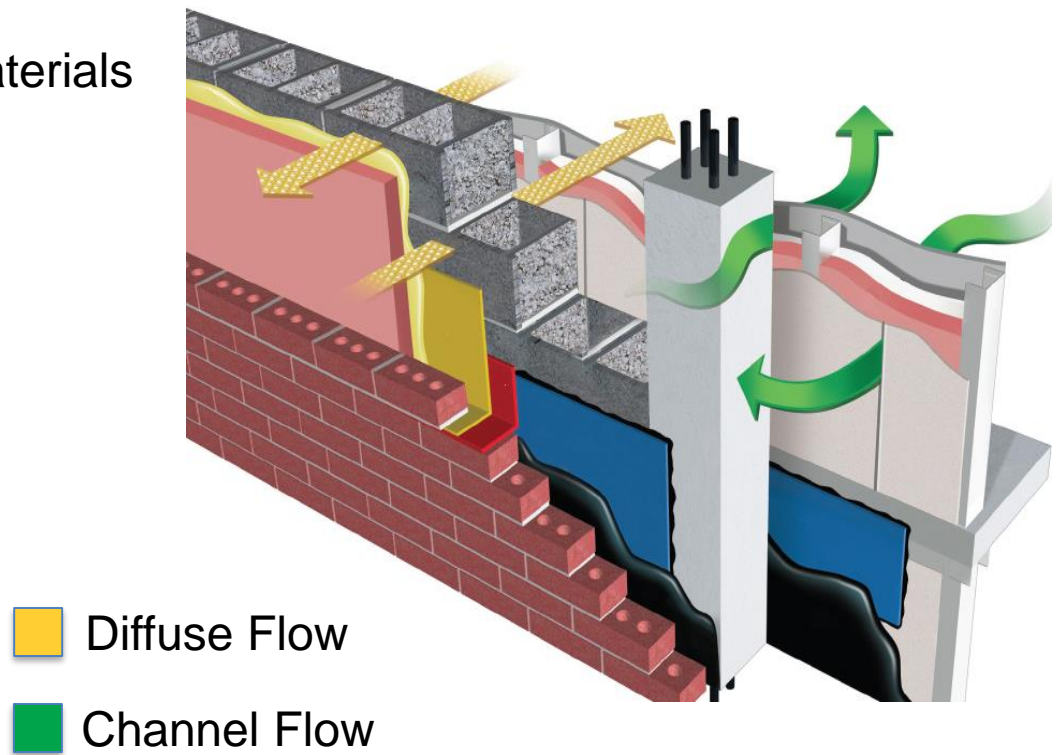
Source: Archdaily  
Urban Town House, Architect: GLUCK

# Evolution of forces that impact walls

## Resist air leakage

### Stop uncontrolled air movement!

- Diffuse flow
  - Air permeance of building materials
  - Lower pressure
  - Porous materials
  - Energy loss \$\$
- Channel flow
  - Leaks and gaps
  - Direct leakage
  - Cracks & breaks
  - Damage \$\$



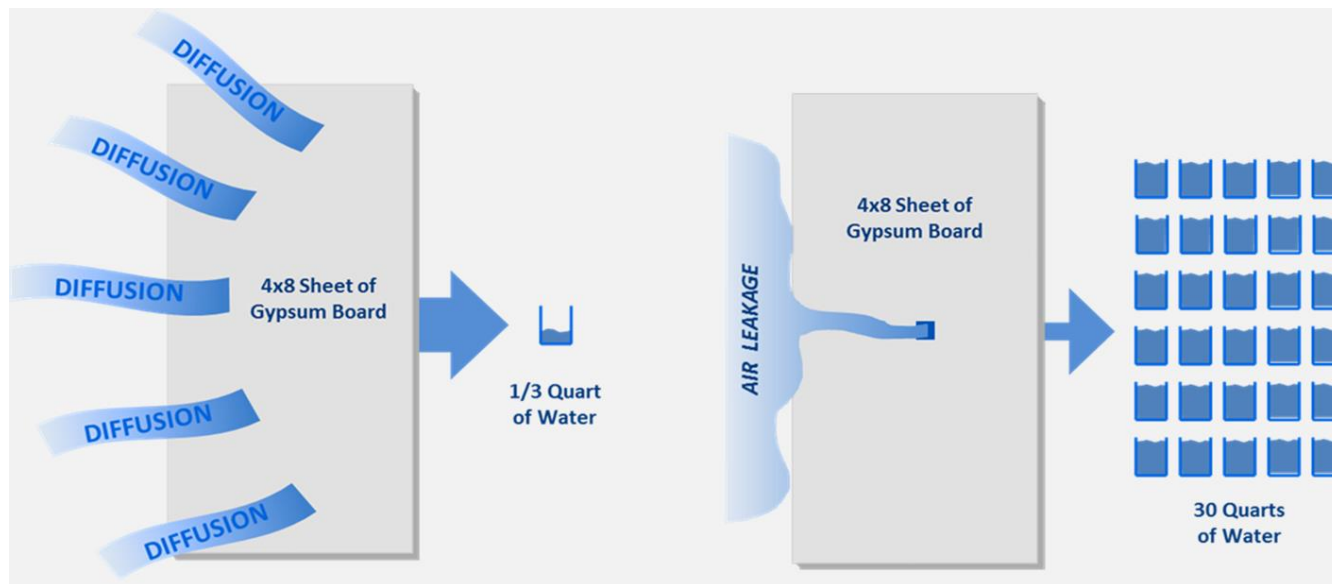
Source: Building Science Corporation

# Evolution of forces that impact walls

## Resist air leakage

### Stop uncontrolled air movement!

- Air Transport = 100 times more water through a small void than Vapor Diffusion through 4x8 sheet



Source: Lstiburek, Joseph. "Insulations, Sheathings and Vapor Retarders." [Research Report- 0412](http://www.buildingscience.com/documents/reports/rr-0412-insulations-sheathings-and-vapor-retarders). (November 2004). 3 January 2013 <<http://www.buildingscience.com/documents/reports/rr-0412-insulations-sheathings-and-vapor-retarders>>.



# Evolution of forces that impact walls

## Resist air leakage

### Stop uncontrolled air movement!

- Industry recognized testing method for determining the air permeance rate of individual materials
  - ASTM E2178 - Standard Test Method for Determining Air Permeance of Building Materials



ASTM E2178 air permeance apparatus  
Source: Architectural Testing, Inc

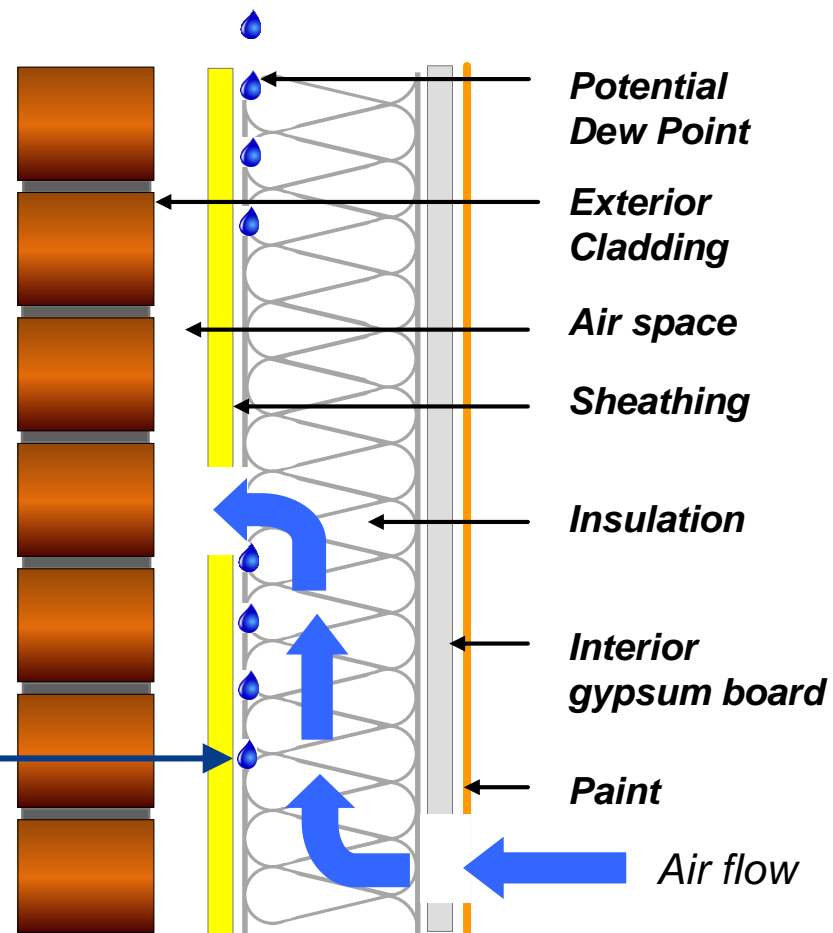
# Evolution of forces that impact walls

## Resist air leakage

### Stop uncontrolled air movement!

- Reduce operational costs
- Eliminates cavity wall condensation

*Uncontrolled air leakage can create condensation at unpredictable locations*



# Evolution of forces that impact walls

## Limit early deterioration

### Protect buildings from mold!

- American Bar Association
  - 200% increase in defect mold litigation in construction since 1990

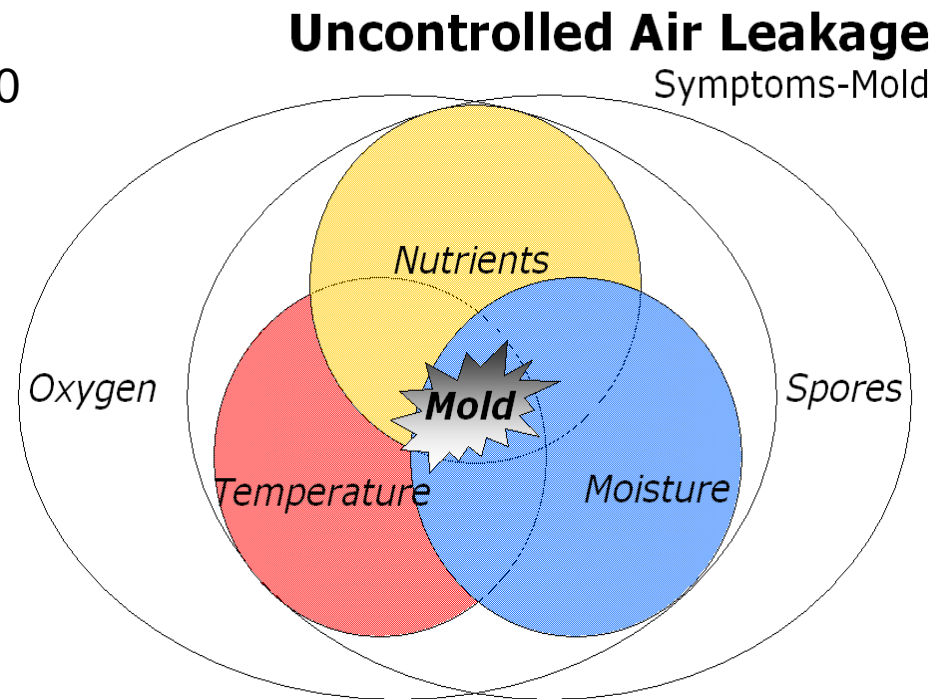
[www.abanet.org](http://www.abanet.org)

- Farmers Insurance
  - Mold claims are up 1100% in the past decade

[www.farmers.com](http://www.farmers.com)

- Mayo Clinic
  - 93% of chronic sinus infections have been attributed to mold

[www.mayoclinic.com](http://www.mayoclinic.com)



# Evolution of forces that impact walls

## Limit early deterioration

Protect buildings from mold



Protect buildings from forces that impact long-term performance!

# **Weather-resistive barrier systems and components**



# Weather-resistant barrier systems and components

## Types of residential and light commercial WRBs

### Weather-resistant barriers

- Mechanically attached
  - Asphalt saturated kraft/felt
  - Woven
  - Non-woven
- Integrated WRB Panel
  - Overlaid/laminated OSB
  - Overlaid/laminated insulated OSB
  - Overlaid gypsum sheathing
- Fluid applied
- Self-adhered





# Weather-resistive barrier systems and components

## Types of residential and light commercial WRBs

### Auxiliary Materials

- Flashings
  - Mechanically attached
  - Self-adhered
    - Asphalt, butyl, acrylic and block copolymer
  - Liquid applied flashing
- Sealants
- Self-adhered membrane primer
  - Asphalt based flashings may require primer
  - Air barrier applications below 20 °F
- Asphalt saturated kraft
  - Secondary layer for stucco and masonry



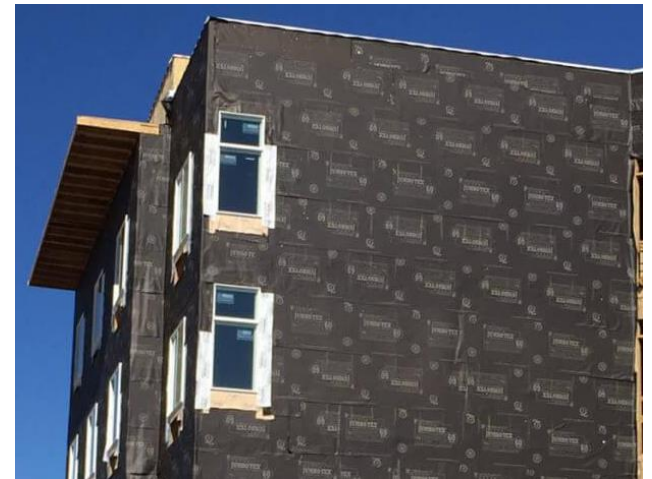
# Weather-resistive barrier systems and components

## Types of residential and light commercial WRBs

### Mechanically-attached

#### Asphalt saturated kraft (ASK) and felt

- Attributes
  - Cost-effective
  - Meets bulk water resistance standards
  - Dries quickly
- Considerations
  - UV exposure: cover immediately
  - Susceptible to job site abrasion
  - Does not qualify as an air barrier
  - Limited warranty
  - Felt not used as a slip-sheet, bond breaker or sacrificial layer



# Weather-resistive barrier systems and components

## Types of residential and light commercial WRBs

### Mechanically-attached

#### Woven

- Attributes
  - Cost-effective
  - Meets bulk water resistance standards
- Considerations
  - UV exposure: cover immediately
  - Susceptible to job site abrasion
  - Does not qualify as an air barrier
  - Long-term performance impacted by surfactants
  - Limited warranty



Source: Green Building Advisor

# Weather-resistant barrier systems and components

## Types of residential and light commercial WRBs

### Mechanically-attached

#### Non-woven

- Attributes
  - Meets bulk water resistance standards
  - Meets minimum air barrier requirements
  - Improved UV exposure
- Considerations
  - Tear strengths may vary
  - Susceptible to job site abrasion
  - Surfactant resistance may vary
  - Assembly price may vary depending on auxiliary component requirements





# Weather-resistive barrier systems and components

## Types of residential and light commercial WRBs

### Integrated WRB panels

#### Overlaid/laminated OSB

- Attributes
  - Quick installation
  - Air barrier integrated on sheathing panel
- Considerations
  - Sheathing joint flashing
  - Reverse laps at taped seams
  - Limited drying potential of OSB
  - Low permeability
  - Fastener penetration water-tightness



Source: Prosales Magazine

# Weather-resistive barrier systems and components

## Types of residential and light commercial WRBs

### Integrated WRB panels

#### Overlaid/laminated insulated OSB

- Attributes

- Quick installation
- Air barrier integrated on sheathing panel

- Considerations

- Dew point between WRB and OSB layers
  - Possible delamination
- Polyisocyanurate unstable when wet
- Foam/substrate compression may lead to uneven cladding
- Sheathing joint and faster penetration flashing
- Impermeable



Source: Building Enclosure Online

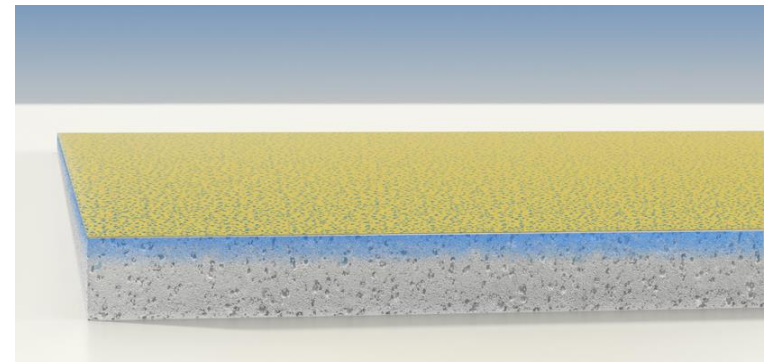
# Weather-resistive barrier systems and components

## Types of residential and light commercial WRBs

### Integrated WRB panels

#### Overlaid gypsum sheathing

- Attributes
  - Quick installation
  - Air barrier integrated on sheathing panel
  - Vapor permeable
- Considerations
  - Sheathing joint flashing
  - Reverse laps at taped seams
  - Fastener penetration water-tightness
  - Must accommodate shrinkage and movement of wood framing



Source: Continuing Education Center Architecture + Construction



# Weather-resistive barrier systems and components

## Types of residential and light commercial WRBs

### Fluid applied

- Attributes
  - Fully adhered to substrate
  - No seams
  - Self-gasketing
  - Ideal for irregular and concrete substrates
- Considerations
  - Requires skilled labor and proper equipment
    - May wash off if not fully cured prior to rain event
  - Typically cannot install in low temperatures
  - Possible overspray



# Weather-resistive barrier systems and components

## Types of residential and light commercial WRBs

### Self-adhered






- Attributes
  - Peel and stick (no fastener penetrations)
  - Fully adhered to substrate
  - Self-gasketing
  - Vapor permeable
  - Ideal for projects requiring increased long-term energy performance
- Considerations
  - Requires a clean and dry substrate
  - Typically requires primer when installed below 20 °F



# Weather-resistive barrier systems and components

## Types of residential and light commercial WRBs

### Performance summary

 <p><b>Woven, ASK and felt WRBs</b></p> <ul style="list-style-type: none"><li>• Ideal for budget constraints</li><li>• Mechanically attached</li><li>• Residential construction</li><li>• Meets minimum WRB requirements</li></ul> <p>Considerations</p> <ul style="list-style-type: none"><li>• Susceptible to site abrasion</li><li>• Limited UV exposure</li></ul>	 <p><b>Integrated panel WRB</b></p> <ul style="list-style-type: none"><li>• Ideal for high wind areas susceptible to WRB damage</li><li>• Mechanically attached</li><li>• Residential and light commercial construction</li><li>• Qualifies as an air barrier (ASTM E2178)</li><li>• Optional insulation</li></ul> <p>Considerations</p> <ul style="list-style-type: none"><li>• Fastener and panel joint flashing required</li><li>• Dew point between WRB and OSB layers</li></ul>	 <p><b>Non-woven WRB</b></p> <ul style="list-style-type: none"><li>• General purpose</li><li>• Mechanically attached</li><li>• Residential and light commercial construction</li><li>• Qualifies as an air barrier (ASTM E2178)</li><li>• May meet ICC-ES AC38</li><li>• UV resistance up to 12 months</li><li>• Drainable options</li></ul> <p>Considerations</p> <ul style="list-style-type: none"><li>• Susceptible to site abrasion</li><li>• Surfactant resistance varies</li></ul>	 <p><b>Fluid applied WRB</b></p> <ul style="list-style-type: none"><li>• Ideal for concrete and irregular substrates</li><li>• Fully adhered</li><li>• Spray</li><li>• Roll applied</li><li>• No seams</li><li>• Residential and light commercial construction</li><li>• Qualifies as an air barrier (ASTM E2178)</li><li>• Nail sealability (ASTM D1970)</li></ul> <p>Considerations</p> <ul style="list-style-type: none"><li>• Special equipment</li><li>• Susceptible to low temperatures/rain</li><li>• Must verify millage</li></ul>	 <p><b>Self-adhered WRB</b></p> <ul style="list-style-type: none"><li>• Ideal for high wind areas susceptible to WRB damage</li><li>• Fully adhered</li><li>• Peel and stick</li><li>• Fully adhered seams</li><li>• Residential and light commercial construction</li><li>• Qualifies as an air barrier (ASTM E2178)</li><li>• Nail sealability (ASTM D1970)</li><li>• ICC-ES AC38</li></ul> <p>Considerations</p> <ul style="list-style-type: none"><li>• Primer required at low temperatures</li></ul>
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# **Specification, design and material selection influences**

# Specification, design and material selection influences

## Things to consider

Design Considerations	Influences
<ul style="list-style-type: none"><li>• Risk evaluation</li><li>• Project budget</li><li>• Geography</li><li>• Regional/local building and energy codes</li><li>• Association and standards</li><li>• Product availability and sales support</li><li>• Evolving construction materials, methods and design</li></ul>	<ul style="list-style-type: none"><li>• Media: print, websites</li><li>• Social media</li><li>• Experts: building science consultants, architects</li></ul>

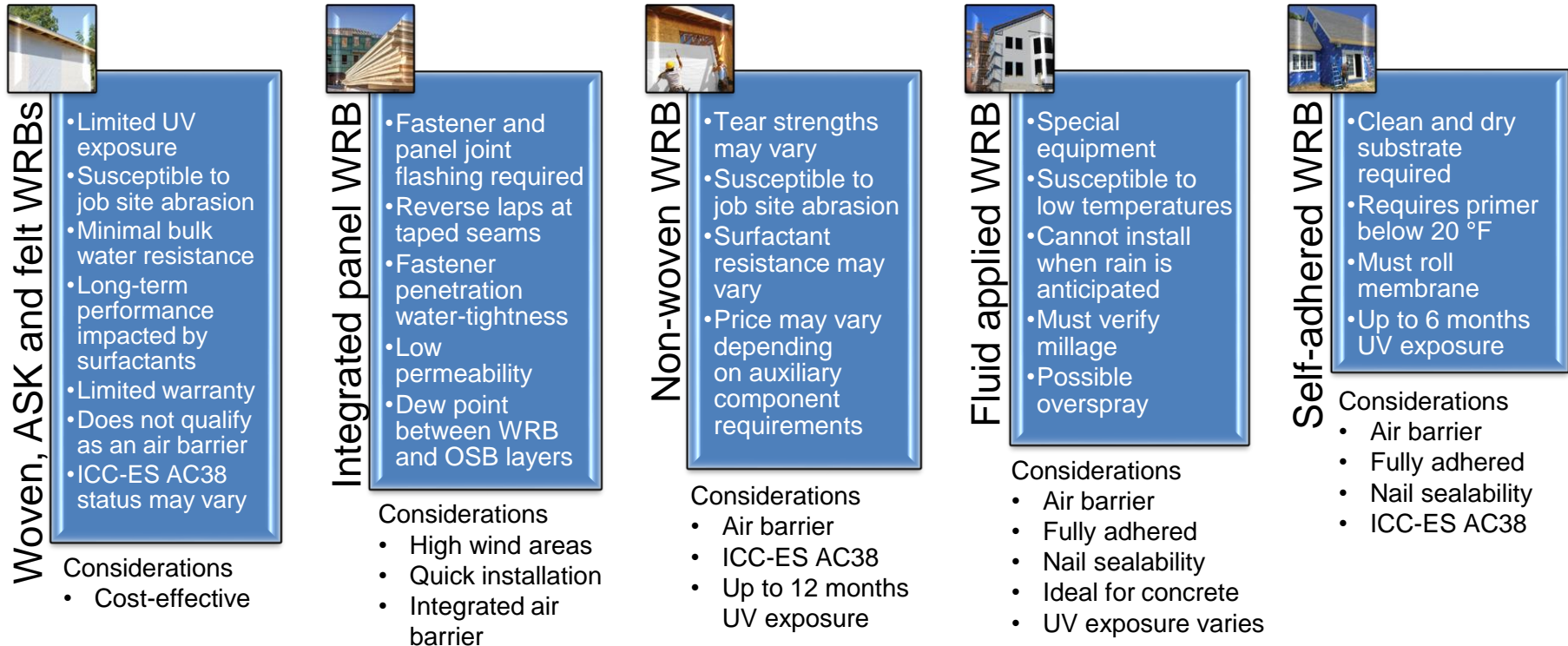
# Weather-resistive barrier systems and components

## Risk evaluation

- Identify project specific long term performance and liability expectations

## Higher risk

## Lower risk



# Specification, design and material selection influences

## Project budget

- Fixed cost
  - Builders less likely to use premium products or systems
- Cost-plus
  - Builder able to sell value of upgraded products or systems
- Return on investment
  - Build-to-own
  - Build-to-sell
  - Build-to-rent/lease
- Value over cost
  - Increased spend on X, results in realized cost savings in Y and Z

Project Management Triangle





# Specification, design and material selection influences

## Geography

- Location
  - Exposure (oceanfront, mountainside)
  - Orientation (UV and wind)
- Climate/Elements
  - Humidity, snow loads, annual rainfall and UV exposure
- Labor Market
  - Skilled labor vs unskilled labor
  - Familiarity and comfort
- Design
  - Based on climate, budget, product availability, regional practices



# Specification, design and material selection influences

## Regional/local building and energy codes

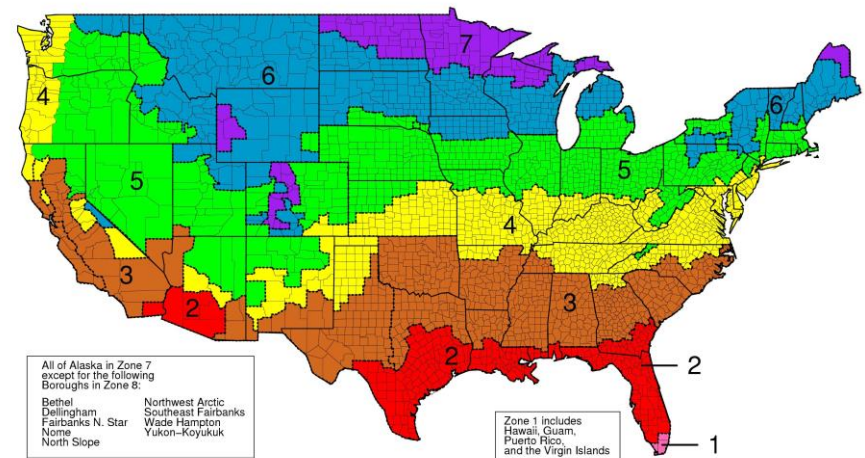
- International Building Code
- International Residential Code
- International Energy Conservation Code



# Specification, design and material selection influences

## Regional/local building and energy codes

- International Energy Conservation Code (IECC) air barrier requirements
  - Air barrier requirements
    - 2012 IECC – climate zones 4 and greater
    - 2015 and 2018 IECC - all climate zones except climate zone 2B
  - Air changes per hour (ACH) in zones 4, 5 and 6
    - 2009 IECC – 3.5 ACH or prescriptive path
    - 2012 IECC – 3.5 ACH or less
    - 2015 IECC – 3.0 ACH or less
    - 2018 IECC – 3.0 ACH or less



# Specification, design and material selection influences

## Associations and standards

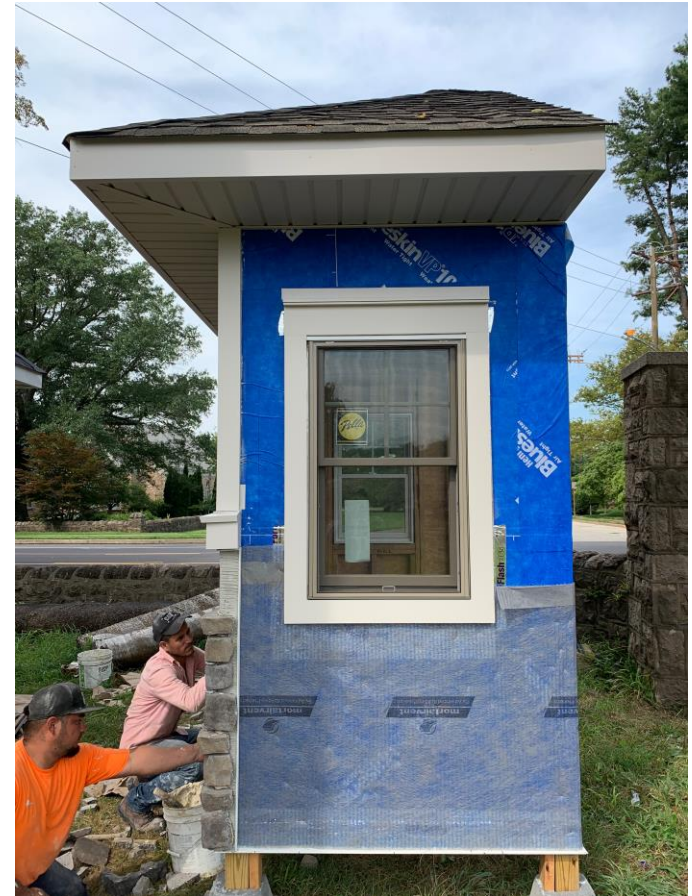
- USGBC LEED
  - LEED Buildings to perform 25 – 30% better in conjunction with ASHRAE
- ASHRAE
  - 90.1-2010: 30% energy savings compared to 90.1-2004
  - ASHRAE 62 Acceptable Indoor Air Quality
  - ASHRAE 189 Standard for the Design of High Performance
- US Army Corp of Engineers
  - USACE Air Leakage Test Protocol
  - ECB 29--2009 Building Air Tightness and Air Leakage
- Industry Experts
  - Building science professionals and consultants



# Specification, design and material selection influences

## Product availability and sales support

- Product availability
  - Lack of distribution
- Manufacturer specification and installation support
  - Constant contact through specification and sales processes
  - Mock up walls
  - Pre-construction meetings
  - Installation training/inspection
- Warranty realization
  - False warranty claims
  - **Nothing is 100% leak free!**





# Specification, design and material selection influences

## **Evolving construction materials, methods and design**

- Surfactant resistant WRBs required with some exterior claddings
- Drainable WRBs recommended for cementitious or composite claddings
- UV stable WRBs required for open-joint claddings



Source: Houzz.com

# Specification, design and material selection influences

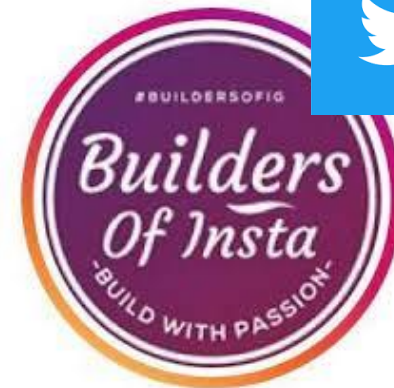
## Social media

- Influencers

- Sponsored individual with a high volume of followers promote conflicting systems and practices

- Manufacturer focus

- More and more manufacturers are turning to these influencers to promote products



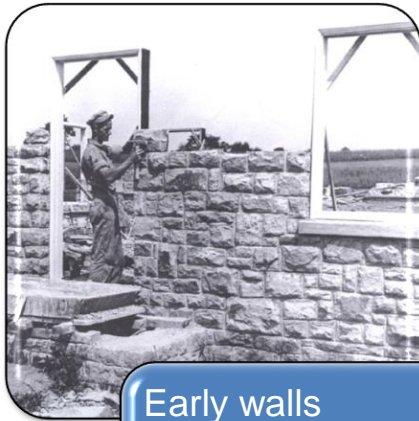


# Summary

# Summary

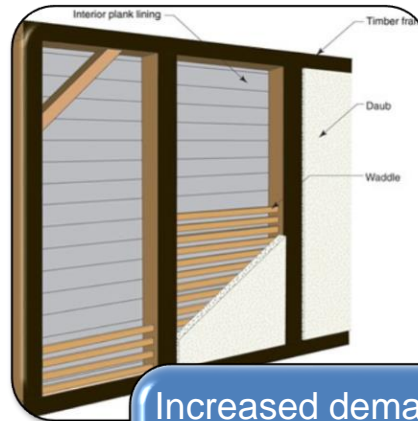
## Evolving wall systems

- Building designs and expectations have changes dramatically!



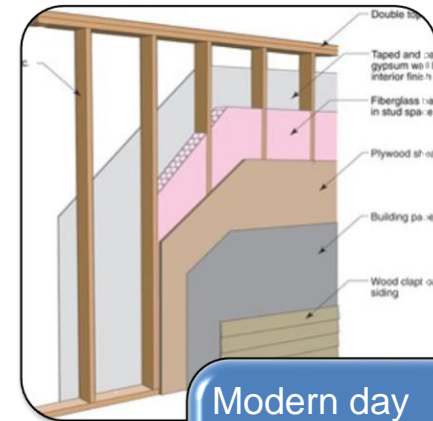
### Early walls

- Primary focus is weather resistance
- Local materials:
  - Wood framing or mass masonry
- Dried quickly
- Durable



### Increased demand for occupant comfort

- Increased insulation use
- Stable indoor seasonal temperatures
- Decreased heating and cooling operational costs
- International building codes establish minimum construction requirements



### Modern day challenges

- Increased focus on long-term durability
- Protect against energy loss
- Air quality
- Anticipate condensation
- Avoid mold and early deterioration
- Accommodate advanced wall designs and technology requirements

# Summary

## Evolution of forces that impact walls

- Protect buildings from forces that impact long-term performance!
  - Manage bulk water
  - Maximize thermal resistance
  - Allow wall assemblies to dry
  - Resist air leakage
  - Limit early deterioration

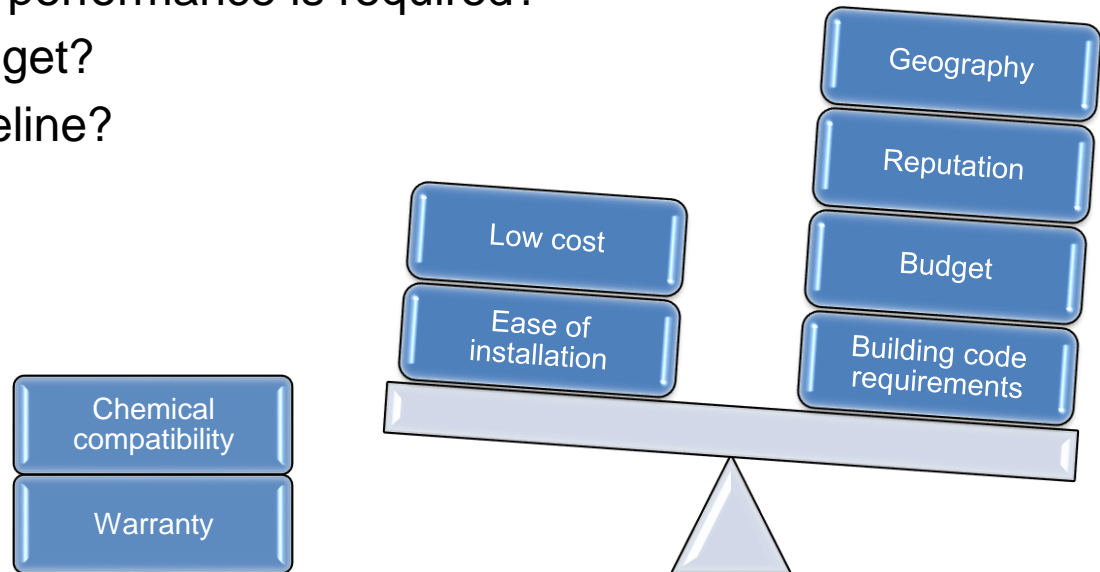


Source: Building Science Corporation

# Summary

## Weather-resistive barrier systems and components

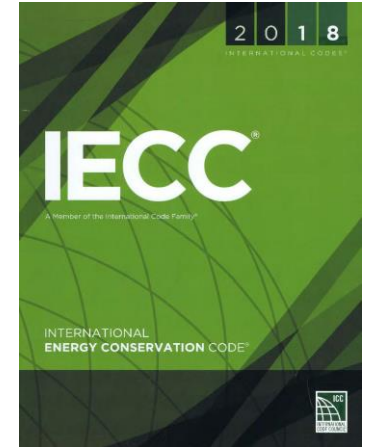
- Select a system that meets the project specific long term performance and liability expectations
  - What type of project is it?
  - Where is the building located?
  - What kind of long-term performance is required?
  - What is the project budget?
  - What is the project timeline?



# Summary

## Influences and Drivers on Specification and Material Selection

- Building and energy codes, association and standards, product availability and sales support, and social media



# Summary

## Depend on a system you can trust!

- Nearly 70% of construction litigation is due to moisture intrusion
- Utilize a single source manufacturer
- Design and install a compatible system
- Obtain a comprehensive warranty





# Summary

This concludes the AIA presentation for continuing professional education.



How can Henry Company help make your project successful?

## Single source of protection

- Wall systems
  - Self-adhered and mechanically attached
    - Water-resistive barriers (WRBs)
    - Air barriers
    - Window system flashings
- Self-adhered roofing underlayments
  - For use under shingles, tile, metal, shake, slate and other sloped roofing surfaces
- Foundation systems
  - Below grade walls, foundation vapor barriers and drainage boards



# Henry Company solutions

How can Henry Company help make your project successful?

## Single source of protection



### Multiple products may affect

- Product availability
- Sales support
- Chemical compatibility
- Warranties



### Single source means....

- Local and regional distribution
- On site training/observations
- Product certainty
- Single source warranties

## Types of residential and light commercial WRBs

### Weather-resistive barriers

- Mechanically attached
  - PlyDry®
  - JumboTex®
  - Super JumboTex® 60 minute
  - Two-ply JumboTex®
  - Two-ply Super JumboTex® 60 minute
  - WeatherSmart®
  - WeatherSmart Commercial
  - WeatherSmart Drainable
  - HydroTex™
- Self-adhered
  - Blueskin® VP100



Blueskin® VP100  
Self-adhered water resistive air barrier membrane



WeatherSmart® Commercial  
Moisture protection with outstanding UV and surfactant resistance



WeatherSmart® Drainable  
Exceeds drainage efficiency standards



WeatherSmart®  
Breathable, water resistance that withstands jobsite rigors



HydroTex™  
Hybrid protection with drainage and labor savings



Two-Ply Super JumboTex® 60 min  
Industry leading building paper in a labor saving roll



Super JumboTex® 60 min  
The leading 60 minute building paper



Two-Ply JumboTex®  
Protection with a labor-saving 2 ply roll



JumboTex®  
Dependable water resistance that's stucco friendly



PlyDry®  
Affordable protection

# Henry Company solutions

## Types of residential and light commercial WRBs

### Performance summary



PlyDry®

- Ideal for budget constraints
- Mechanically attached
- Residential construction
- Meets minimum WRB requirements

#### Considerations

- Susceptible to site abrasion
- Limited UV exposure



JumboTex®

- Family of ASK options, ideal for stucco and masonry
- Mechanically attached
- Residential and light commercial construction
- Cost effective

#### Considerations

- Limited UV exposure



HydroTex™

- 2 layers: WeatherSmart Drainable plus Super Jumbo Tex
- 2 Ply provides installation labor savings
- 95% drainage efficiency
- Ideal for stucco and masonry

#### Considerations

- Limited UV exposure



WeatherSmart®

- General purpose family of products
- Mechanically attached
- Residential and light commercial construction
- Extended UV options
- Excellent surfactant resistance
- NFPA 285 qualified wall assemblies

#### Considerations

- Susceptible to site abrasion



Blueskin® VP100

- Ideal for high wind areas susceptible to WRB damage
- Fully adhered
- Peel and stick
- Fully adhered seams
- Residential/ light commercial construction
- Qualifies as an air barrier
- Combats bulk water and wind driven rain
- Nail sealability
- ICC-ES AC38

#### Considerations

- Primer required at low temperatures



# Thank you!

This concludes the AIA presentation for continuing professional education.

## Questions??



**Henry®**