

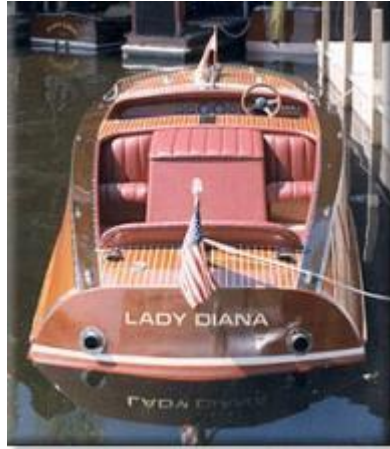


# **The Code, New and Green Technologies**

**Western Southern Tier Building Officials  
Celoron, NY  
T02-07-2841  
September 2021**

# Where I Come From...





*Using less. Doing more.*

NYS Energy Tech Cmte.  
USGBC – IAQ Cmte.  
ICC – SEHPCAC  
ASHRAE 189  
IGCC



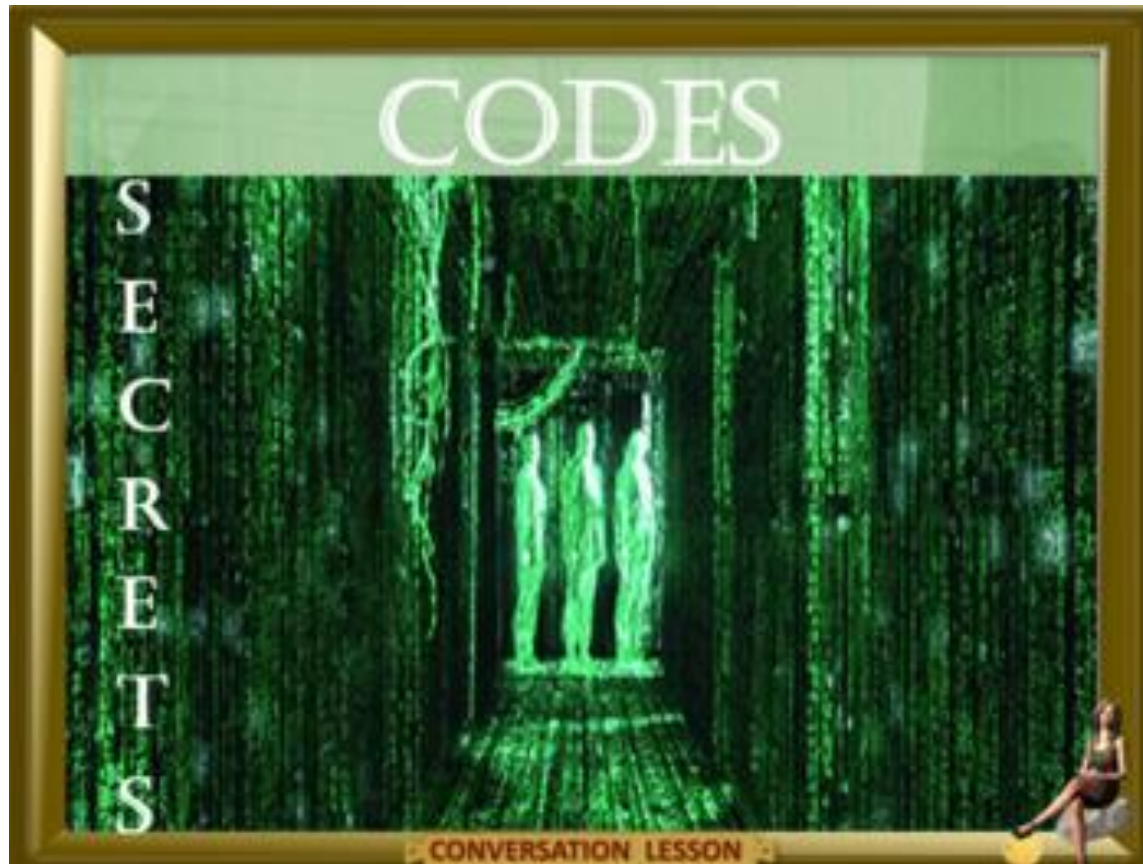
# Most Importantly - Thank You All for Your Service!



Uh OH! DeWein's Gonna Try To  
Turn Us Into A Bunch of Greenies!



Guess What?!  
You Already Are!  
CODES Are The ORIGINAL Green!



# But Before We Dig In...

**Is the Energy Code a Life Health  
Safety Code?**

**Yes...**

**No...**

**Maybe**

**...**

# Anybody Identify This Horrific Fire?





# Anybody Identify This Horrific Fire



**...An Improperly Detailed Energy Code Requirement!!!**

# Do We Think This Will Result in Structural Durability Problems?!



# Do We Think This Will Result in Structural & Durability Problems?!



**...Unenforced/Badly Detailed Energy Code Requirements!!!**



## Water Damage Assessment

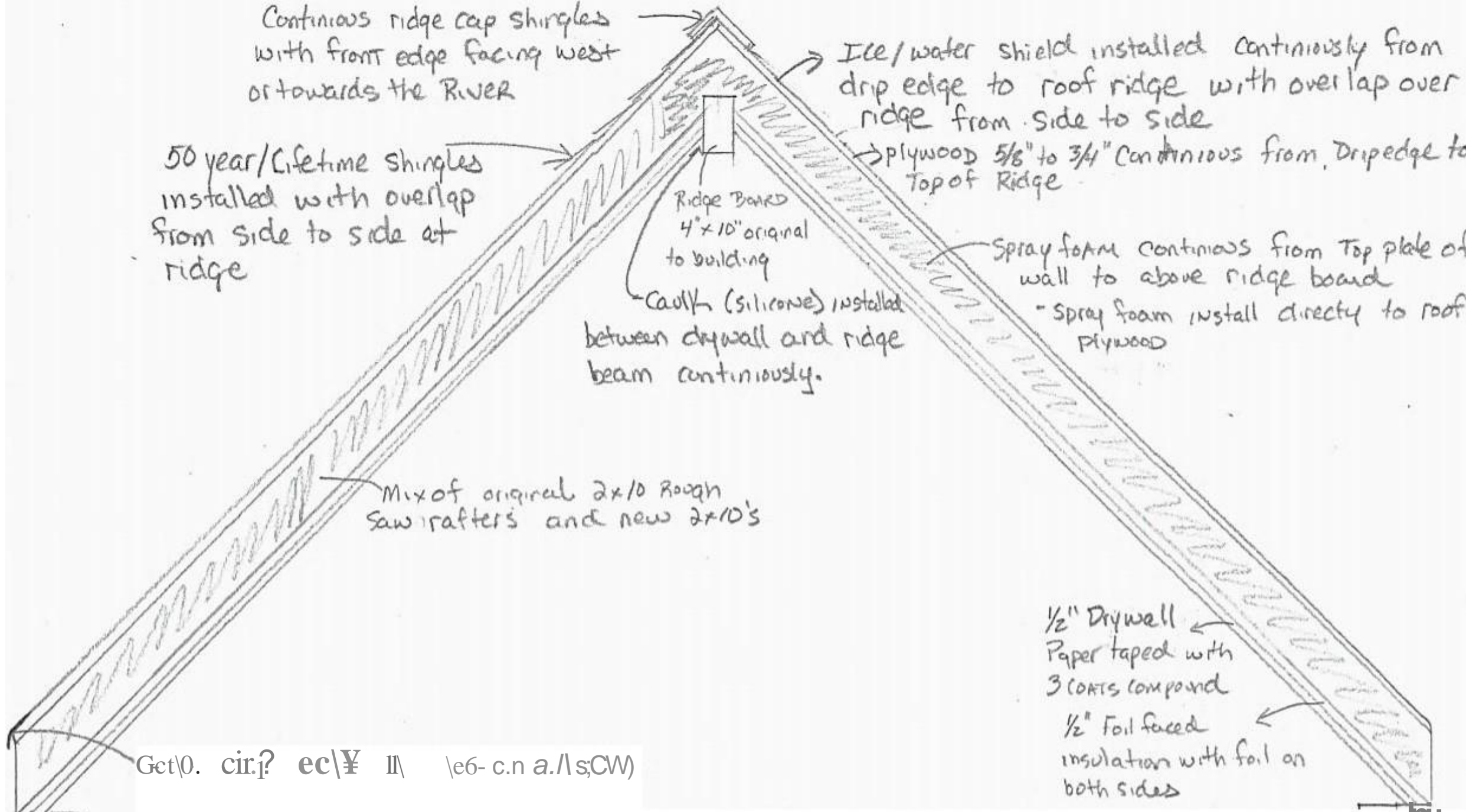


**Do We Think This Might Result in Structural Failure Too,  
As Well As Mold/Rot?!**



# Do We Think This Might Result in Structural Failure?!





Get 0. cir. j? ec \¥ II \e6- c.n a. /s; CW)

ND ve11 1110 11"10 /N'. 4

And This?!





**And This?!**



**...Unenforced/ Badly Detailed Energy Code Requirements!!!  
– Second Highest Insurance Claim in NY**

And This?!



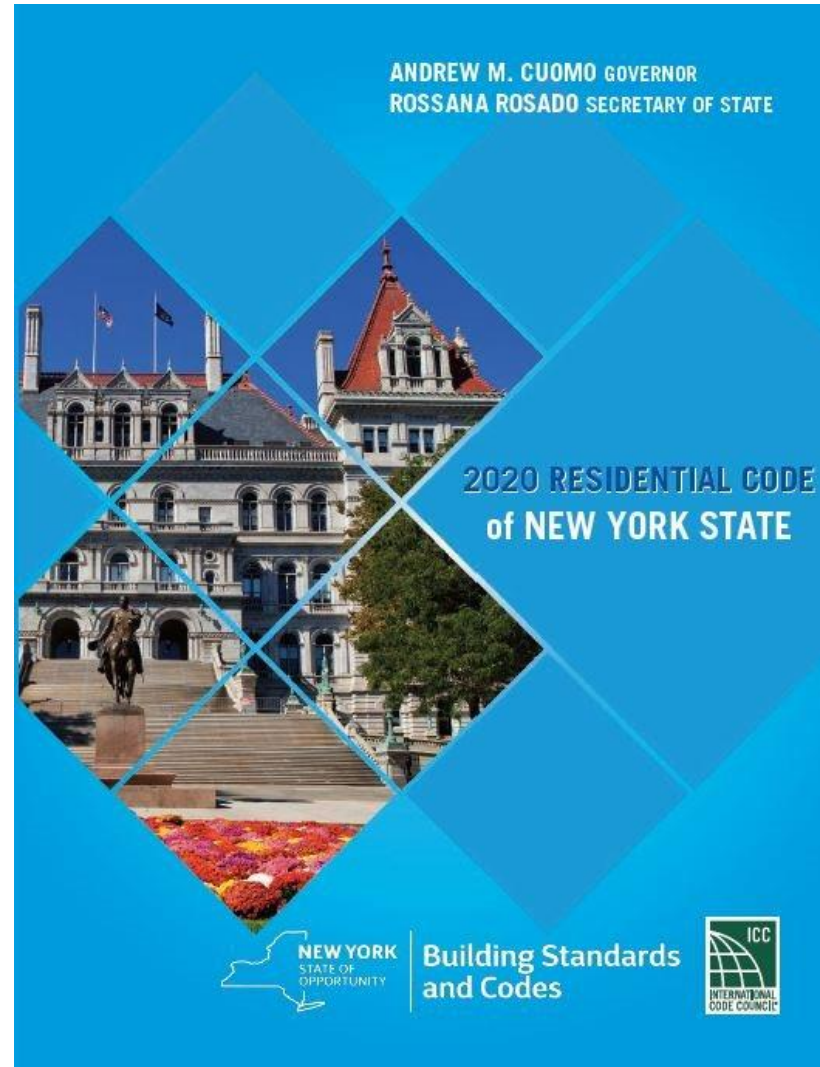
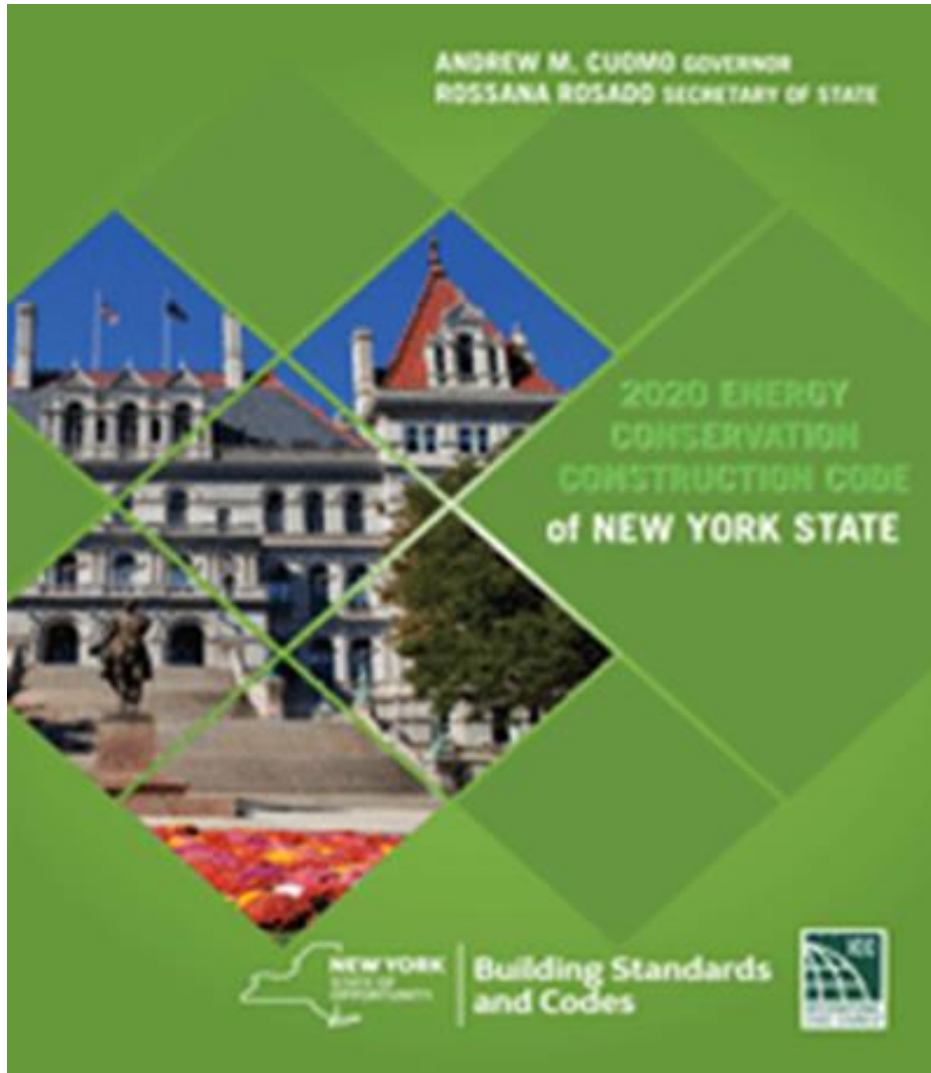
And This?!



**...Unenforced/ Badly Detailed Energy Code Requirements!!!**  
**– MAJOR Cause of CO Poisoning/Death!**

# New York State Codes

Currently – Based on 2018 I-Codes with NY Enhancements



# Code Barriers & Mistakes - Real or Perceived?

- The Energy Code Requires a Poly Vapor Barrier
- My Code Official won't let me do advanced framing
- I can't build an unvented crawlspace in my town
- Are there ANY ventilation requirements in the Code?
- My HVAC Sub won't seal his ducts; isn't that a code requirement?
- I can't get my Builder to detail a proper Drainage Plane, plus he leaves it off the gable end!!
- Do I hafta vent a cathedral ceiling if it's filled with Polyurethane foam?

Meanwhile...



# Improper Substitution



# Mold and Moisture Damage

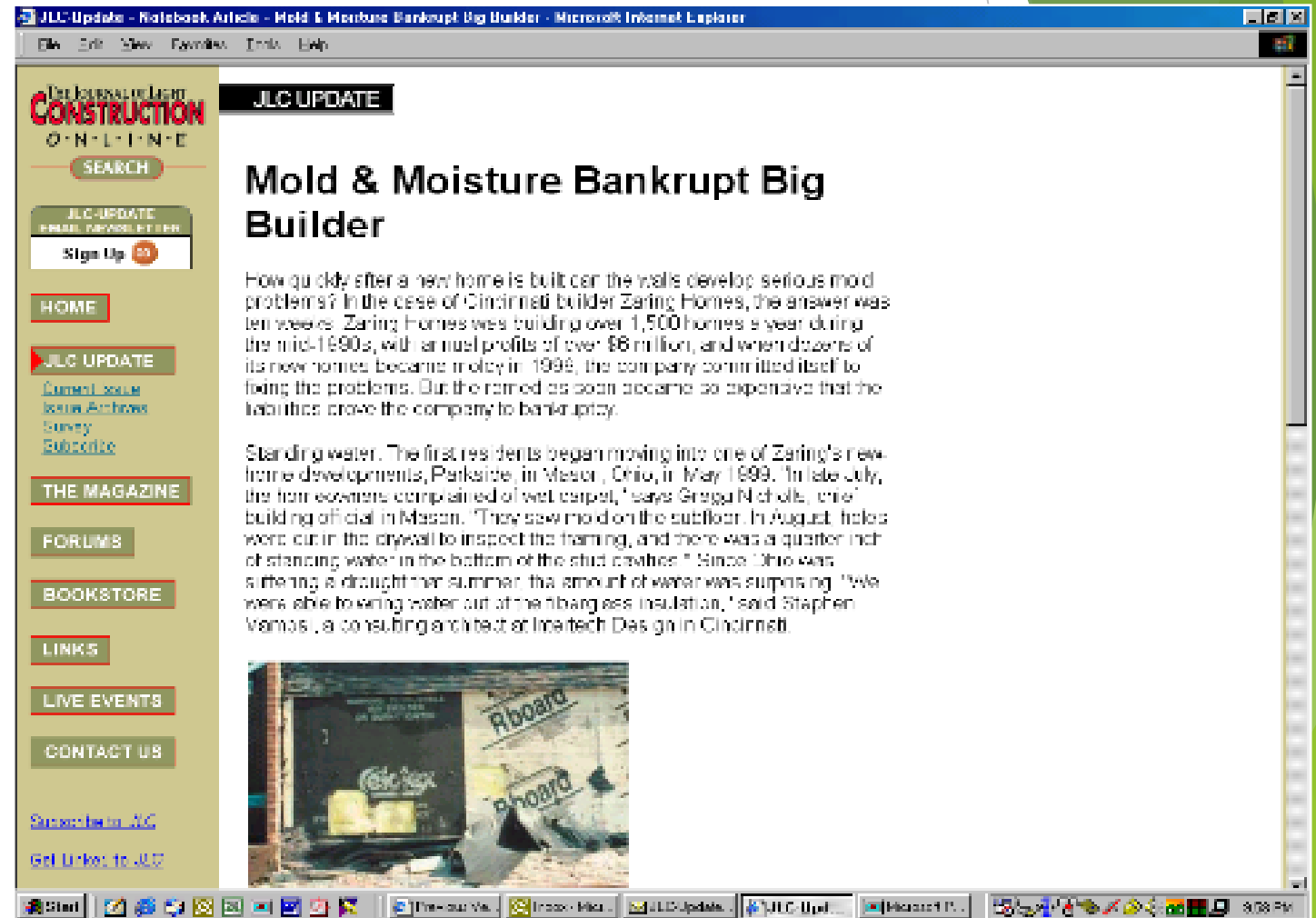




# Meanwhile...

## Zaring Homes:

- Building over 1,500 homes a year during the mid-1990s
- Annual profits of over \$6 million
- Dozens of its new homes became moldy in 1999
- The remedies soon became so expensive it drove the company to bankruptcy.




The screenshot shows a web browser window displaying an article from JLC Update. The browser's address bar shows the URL: "JLC Update - Notebook Article - Mold & Moisture Bankrupt Big Builder - Microsoft Internet Explorer". The page features a navigation menu on the left with links to HOME, JLC UPDATE (highlighted), THE MAGAZINE, FORUMS, BOOKSTORE, LINKS, LIVE EVENTS, and CONTACT US. The main content area has the title "Mold & Moisture Bankrupt Big Builder" and a sub-headline "How quickly after a new home is built can the walls develop serious mold problems? In the case of Cincinnati builder Zaring Homes, the answer was ten weeks. Zaring Homes was building over 1,500 homes a year during the mid-1990s, with annual profits of over \$6 million, and when dozens of its new homes became moldy in 1999, the company committed itself to fixing the problems. But the remedies soon became so expensive that the liabilities drove the company to bankruptcy." Below the text is a photograph of a construction site with a sign that says "Rboard". The taskbar at the bottom shows the Start button and several open applications, including "The our vie", "Inbox - Mic...", "JLC Update", "JLC Upd...", "Microsoft P...", and the system clock showing "8:08 PM".

**JLC UPDATE**

## Mold & Moisture Bankrupt Big Builder

How quickly after a new home is built can the walls develop serious mold problems? In the case of Cincinnati builder Zaring Homes, the answer was ten weeks. Zaring Homes was building over 1,500 homes a year during the mid-1990s, with annual profits of over \$6 million, and when dozens of its new homes became moldy in 1999, the company committed itself to fixing the problems. But the remedies soon became so expensive that the liabilities drove the company to bankruptcy.

Standing water. The first residents began moving into one of Zaring's new-frame developments, Parkside, in Mason, Ohio, in May 1999. In late July, the home owners complained of wet carpet, says Grega Nichols, a city building official in Mason. "They saw mold on the outdoor. In August, holes were cut in the drywall to inspect the framing, and there was a quarter inch of standing water in the bottom of the stud cavities." Since Ohio was suffering a drought that summer, the amount of water was surprising. "We were able to bring water out of the fiberglass insulation," said Stephen Varnos, a consulting architect at Inertech Design in Cincinnati.



# Mold and Moisture Damage



# Meanwhile... Building Performance Programs Expand

## **Nationally:**

US-DOE Building America – Building America Partners

Energy & Environmental Building Association

US-EPA Energy Star Homes

HUD – PATH

Building Performance Institute

Environments for Living

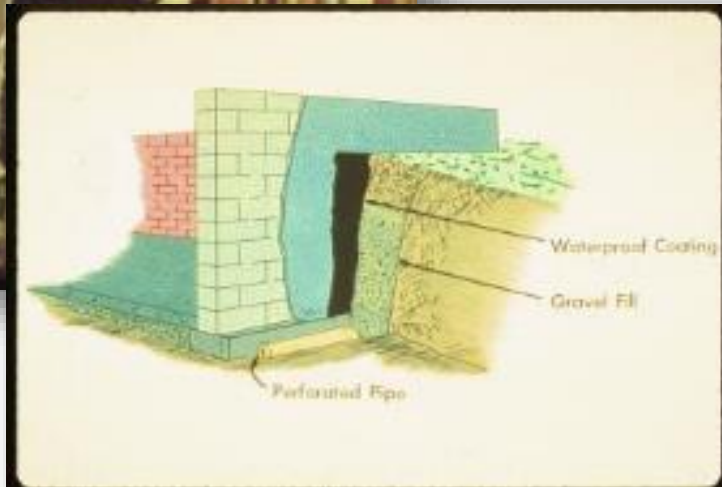
## **At the State Level:**

Home Performance with Energy Star

State Energy Star Labeled Homes

**...and so do the findings from the field**

# Some of the Requirements, “Barriers”



# Vapor Retarders

## Residential Code - Chapter 3

### Residential Code - Section R702.7 “Moisture Vapor Retarder”

Removed from Energy

Intent of Code - Slow Water Vapor Migration by Diffusion  
Type I a BAD idea wherever A/C used, especially Central

# Vapor Retarders

Now in RCNYS - Chapter 7

ECCCNYS-2020 - Chapter 402.1.1, Referencing RCNYS-2020 R702.7 Vapor retarder required on winter warm side... I, II, or III

**- Poly Probably a BAD Idea**

ZONE	CLASS III VAPOR RETARDERS PERMITTED FOR:
5	Vented cladding over OSB Vented cladding over Plywood Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with $R$ -value $> 5$ over 2 x 4 wall Insulated sheathing with $R$ -value $> 7.5$ over 2 x 6 wall
6	Vented cladding over Fiberboard Vented cladding over Gypsum Insulated sheathing with $R$ -value $> 7.5$ over 2 x 4 wall Insulated sheathing with $R$ -value $> 11.25$ over 2 x 6 wall

**Exempt in Zone 4, MANY Improvements**

# Vapor Retarders

Example:  
Poly Vapor Retarder  
*BE CAREFUL!!*



- ▶ Example:  
Kraft-Faced Vapor Retarder

# So, Why Is This and fixing The Codes a GREEN BUILDING Issue?

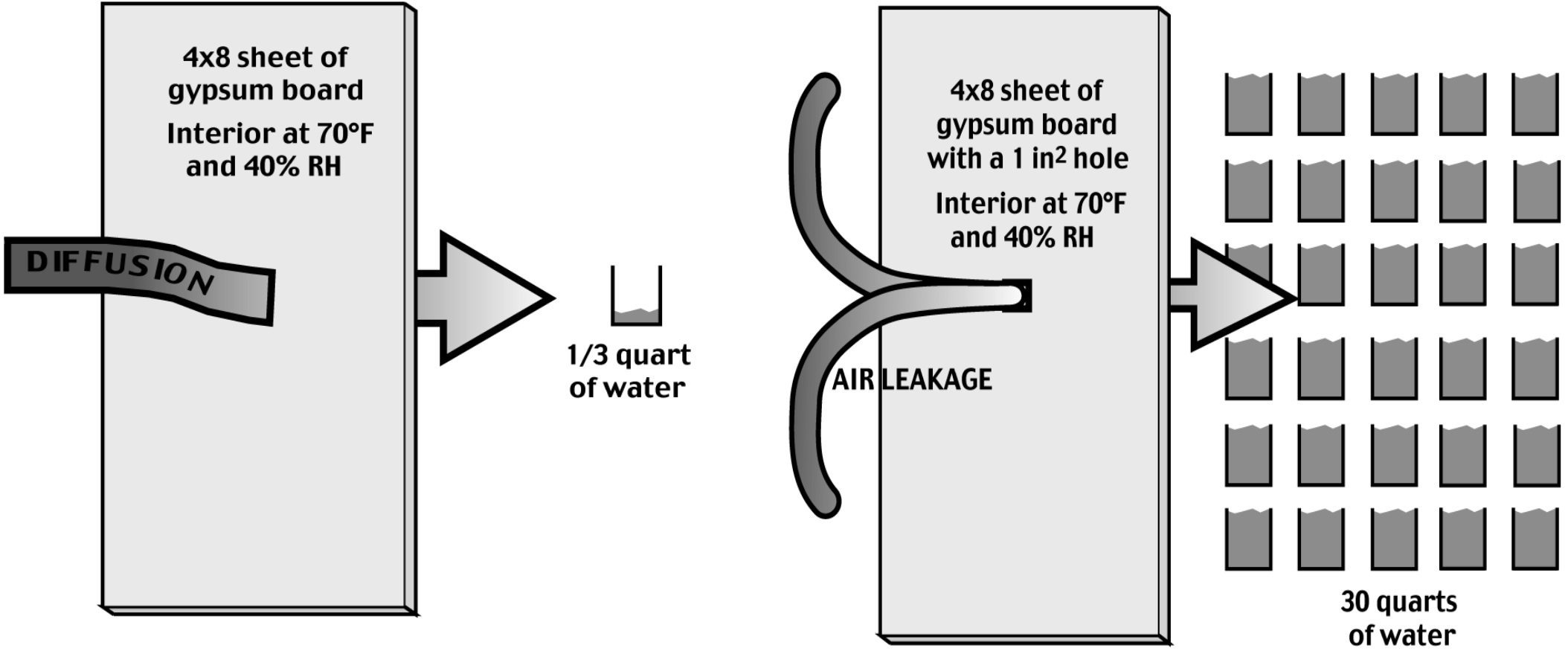




# Physics - Second Law of Thermo- Dynamics States:

- Air Moves From *High* to *Low* Pressure.
- Heat Moves From *Warm* to *Cold*.
- Moisture Moves From *Warm* to *Cold* AND From *Wet* toward *Dry*.
- DeWein's Corollary - Stuff Rolls Down Hill!

# Water Vapor Diffusion



# Vapor Retarders

## Best Practice

- Match the Wall Materials to Climatic and other Design conditions
- Do we want a Poly Vapor Retarder where we are both heating and cooling the house?
- Do we need a Vapor Retarder in Walls that are blown with Foam?
- What do we do for Wet Spray Cellulose in Walls WRT Vapor Retarder?
- Alternate (“Smart”) Vapor Retarders?

# Representative Vapor Permeability Info

<b>Material</b>	<b>Dry Cup</b>	<b>Wet Cup</b>	<b>Comments</b>
Plywood	.75	3.5	Semi-permeable
OSB	.75	2	Semi-
Fiberboard (AI)	14.5	15	Permeable
Thermo Ply	0.5	0.6	impermeable
XPS	1	1	Semi (but with skin, im-)
EPS	5	5	Semi-
6-mil poly	.06	.06	Impermeable
Kraft paper	1	>>1?	Semi- (variable)
MemBrain™	1	10+	Variable, by design
Tyvek®	14	?	permeable
Latex paint (primer + 1 coat)	3.6	6	Semi-

# Smart Vapor Retarders



# Vaulted Ceilings and Venting (or not)

Energy - Chapter 4

Residential - Chapter 8

**Energy Code - Chapter 4, Insulation Requirements ONLY**

**Residential Code - Chapter 806 “Ventilation Required”**

- Ventilation Required in enclosed attics and rafter spaces
- Protected against rain, snow, and critters
- Minimum area 1/150 of roof area OR 1/300 if 80% is high
- Clearance at eaves, **BLOCK INSULATION ENDS**
- ALTERNATE is a Vapor Barrier of 1 Perm or less, Redux to 1/300 allowed
- RCNYS & ECCCNYIS NOW allows for unvented roof assemblies with new rules 2015 & 2020 ECCCNYIS, RCNYS
- NOTE INTENT OF Code - Water Vapor/Moisture control!
- Letter from NY-DOS

# Vaulted Ceilings and Venting (or not)

## Best Practice

**Problem - If proper Air Barrier requirements are met, probably don't need a Vapor Barrier, HOWEVER; Code Still Requires it**

Answer – Get an ES or other report that indicates the system meets code intent w/o ventilation!

Example – Letter from NY-DOS RE: Foam in Vaulted Ceiling

**OK, so what do we think/do about Vapor Retarder and Wet-Spray Cellulose? Or Dense-Pack?**

# Vaulted Ceilings and Venting (or not)

## Best Practice

What ASHRAE Says:

### Vapor, Not Heat!

Although there clearly are potential benefits from attic vents in heating climates, there are also disadvantages: Vents can be prone to snow and rain entry that can wet the insulation, and cold air blowing through eave vents can degrade the thermal performance of attic insulation.... In heating climates, attic ventilation usually provides a measure of protection from excessive moisture accumulation in the roof sheathing, but if indoor humidity is high and humid indoor air leaks into the attic, the use of attic vents does not guarantee that attic moisture problems will not develop. Therefore, moisture control in attics in heating climates depends primarily on maintaining low indoor humidity levels during cold weather and on ensuring sufficient airtightness and vapor resistance (i.e. a vapor retarder) in the ceiling.

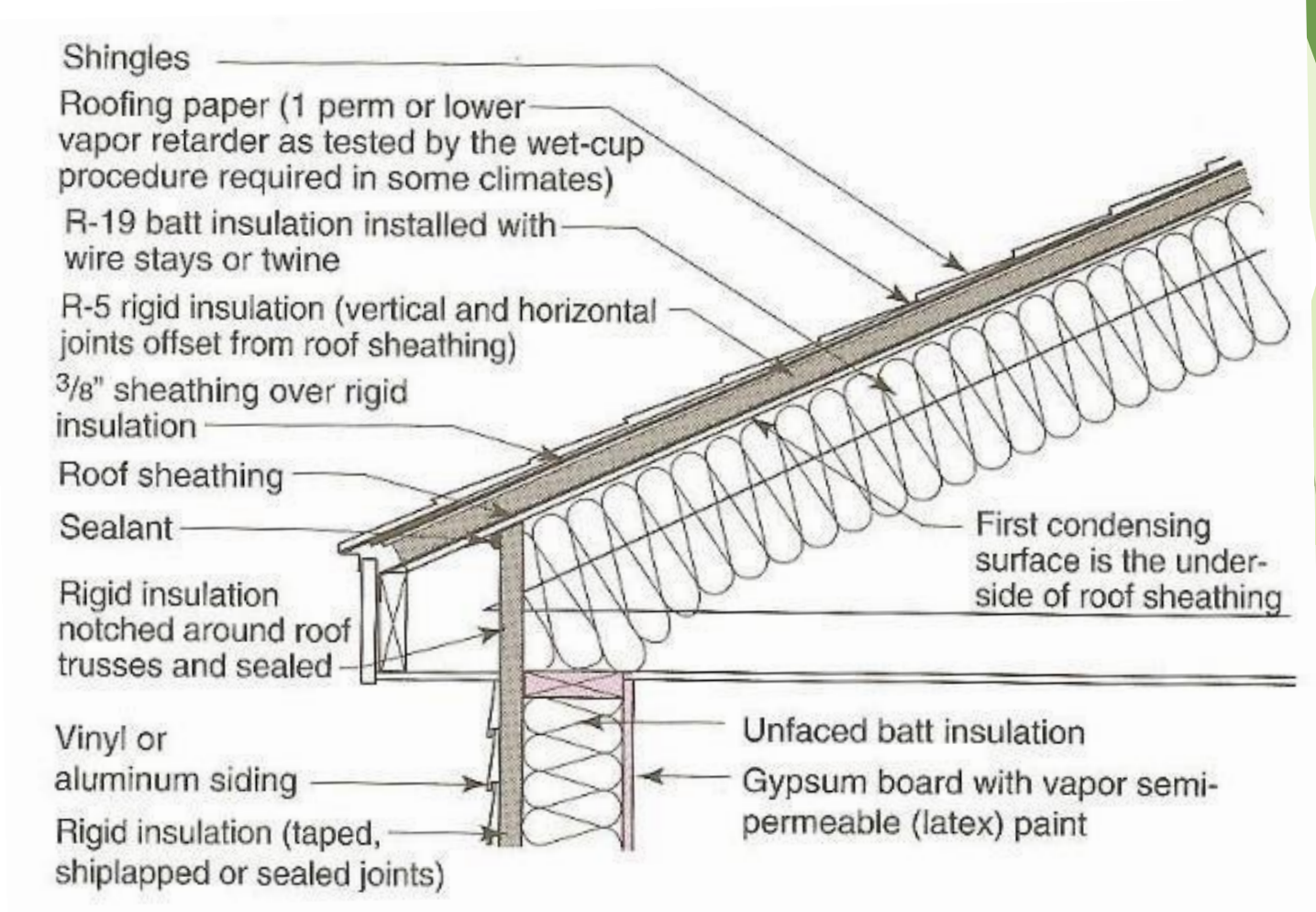
--12017 ASHRAE Handbook, Fundamentals, 23.6



# Vaulted Ceilings and Venting (or not)

## Best Practice

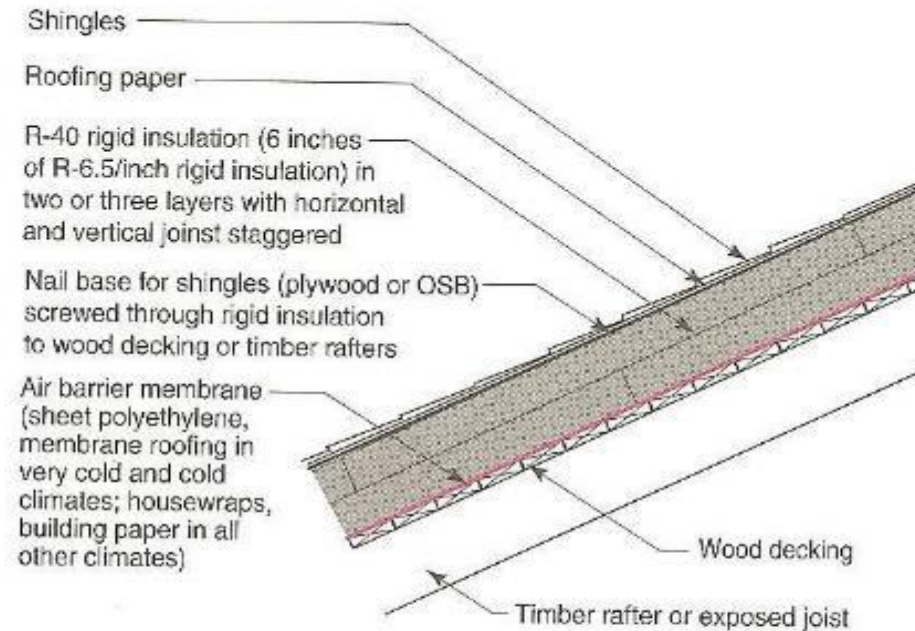
What Joe and the Field Guide Say:



# Vaulted Ceilings and Venting (or not)

## Best Practice

### What Joe and the Field Guide Say:



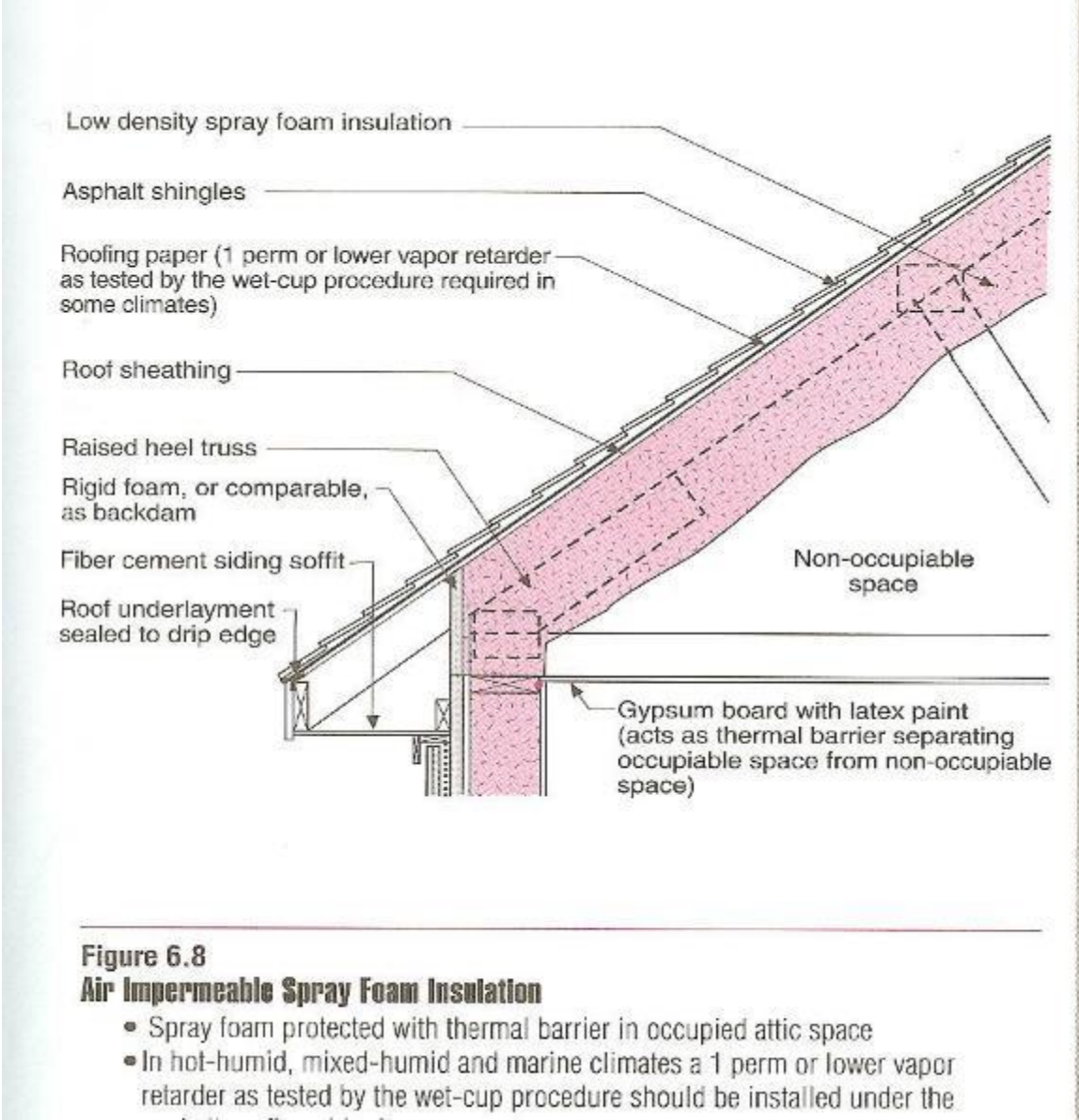
**Figure 6.7**  
**Compact Unvented Roof Assembly**

- R-value increased to R-50 in very cold climate zones to control ice-damming
- Optimum roof assembly design to enclose pool areas and spas

# Vaulted Ceilings and Venting (or not)

## Best Practice

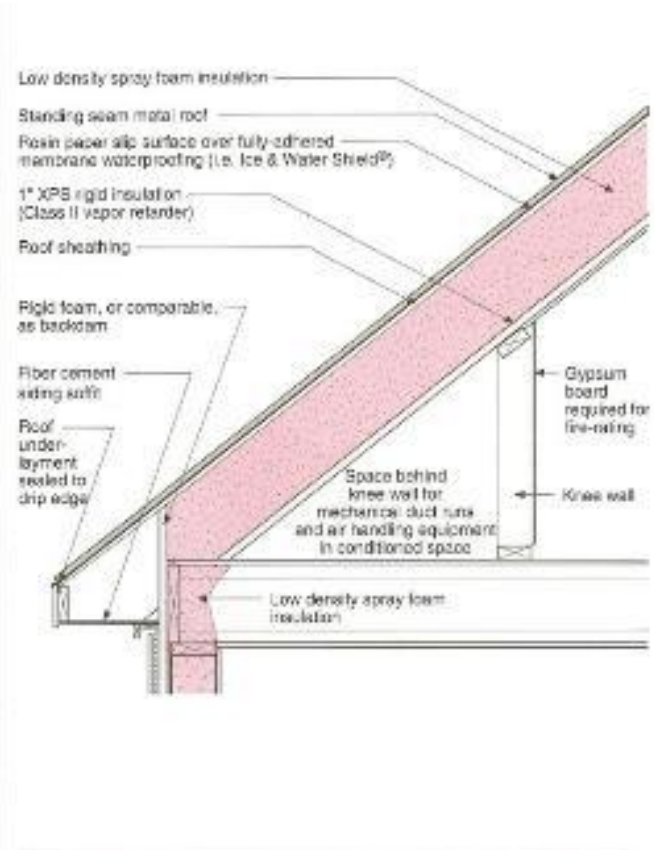
### What Joe and the Field Guide Say:



# Vaulted Ceilings and Venting (or not)

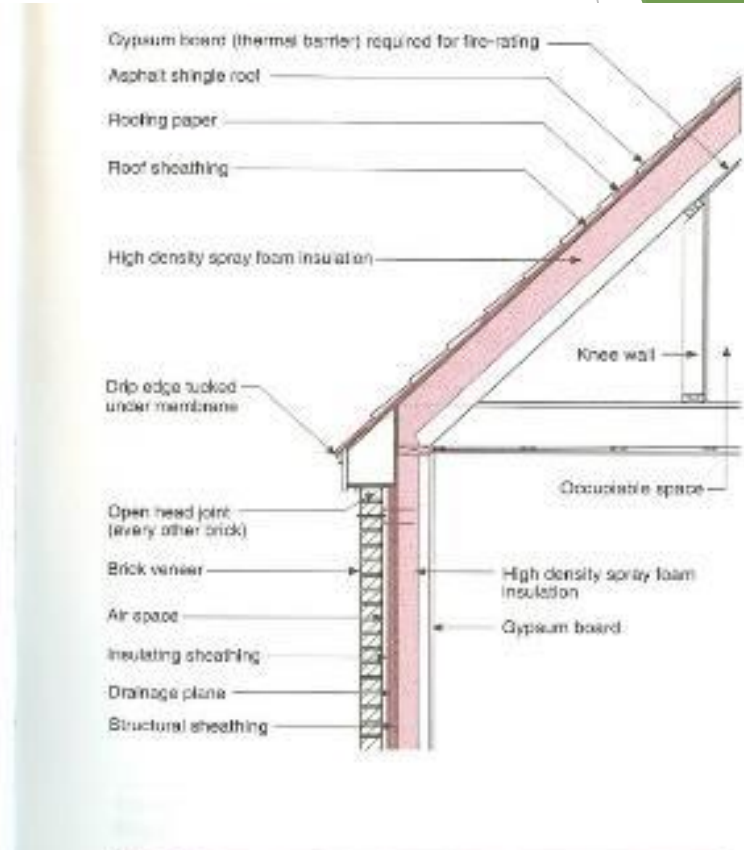
## Best Practice

What Joe and the Field Guide Say:



**Figure 6.9**  
**Air Impermeable Spray Foam Insulation**

- Spray foam protected with thermal barrier in occupied attic space
- Interior vapor retarder (Class I) required with low density spray foam in Climate Zones 6 and 7



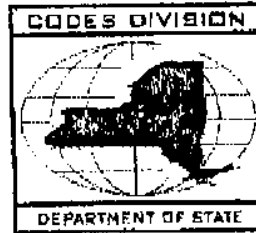
**Figure 6.10**  
**Air Impermeable Spray Foam Insulation**

- Spray foam protected with thermal barrier in occupied attic space
- High density foam insulation partially fills roof rafter cavity and wall cavity
- No interior vapor retarder required in any climate zone with high density spray foam insulation

# Vaulted Ceilings and Venting (or not)

## Best Practice

What the NYS  
Department of State  
Says:



### NEW YORK STATE DEPARTMENT OF STATE

Division of Code Enforcement and Administration  
41 State Street Albany, New York 12231  
Phone no. (518) 474-4073 [Fax] (518) 486-4487

*Facsimile Transmission Sheet*

---

**DATE:** September 1, 2005  
**TO:** ~~Dave Abrey~~ Mike Dewine  
**FAX:** 604-5672  
**FROM:** Cheryl A. Fischer, P.E.  
Assistant Director for Code Interpretation  
**NOTE:** Cathedral Ceiling

This is in response to your question whether the application of spray in foam in the rafter space of a cathedral ceiling, even a flat ceiling, requires ventilation of the space in accordance with *Residential Code of New York State (RCNYS)* section R806.1. NO. Any such impervious material which completely fills the rafter space is permitted without ventilating the roof.

# A Water Management Problem?



# Water Management (Drainage Plane)

Energy Code - N/A Vapor retarder ONLY

Residential Code - Chapter 7

**Energy code - Only deals with Vapor Retarder requirement - does it need more? YES!**

**RCNYS-2020 Sections 703.4 and R703.8.5 - WRT Exterior Coverings & How They Are Detailed w/ flashing**

703.1 – Intent to prevent moisture from getting into wall

703-2 – Weather –resistant sheathing paper or material tested to ASTM D 226 (Housewraps, other building papers)

ONLY required under Brick and Stone veneer

This will be changing in future, in '06 to include Hard Board lap and panel siding, soon for all sidings.

703.7.5 and .8 - Flashing required, vague around siding other than Stone or Brick

Required around openings, doors, windows, fairly vague

# Water Management (Drainage Plane)

Energy Code - N/A Vapor retarder ONLY

Residential Code - Chapter 7 703.3.(1)

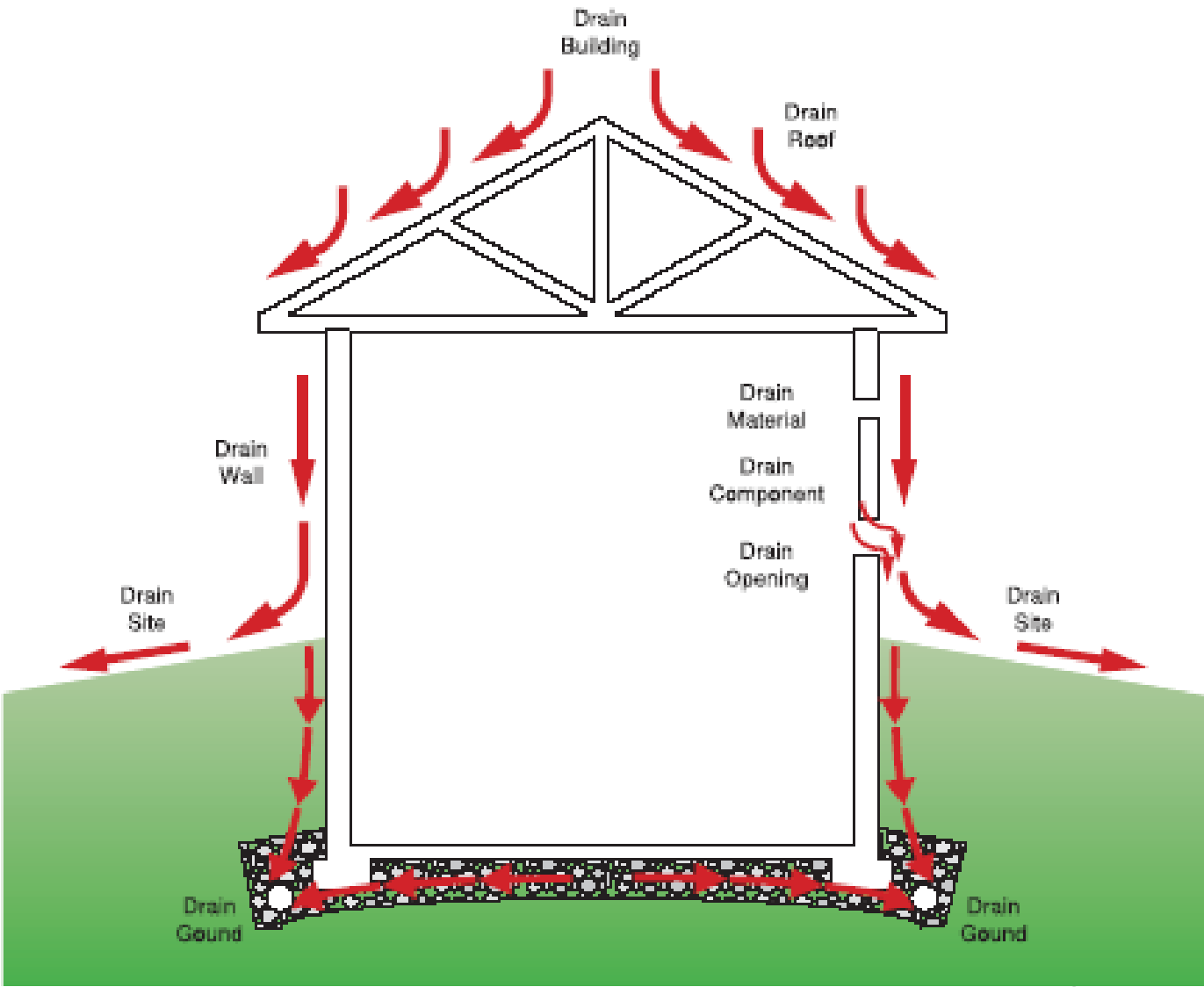
**Changing to include most ALL Siding, check the RCNYS-2020!**

TABLE R703.3(1)  
SIDING MINIMUM ATTACHMENT AND MINIMUM THICKNESS

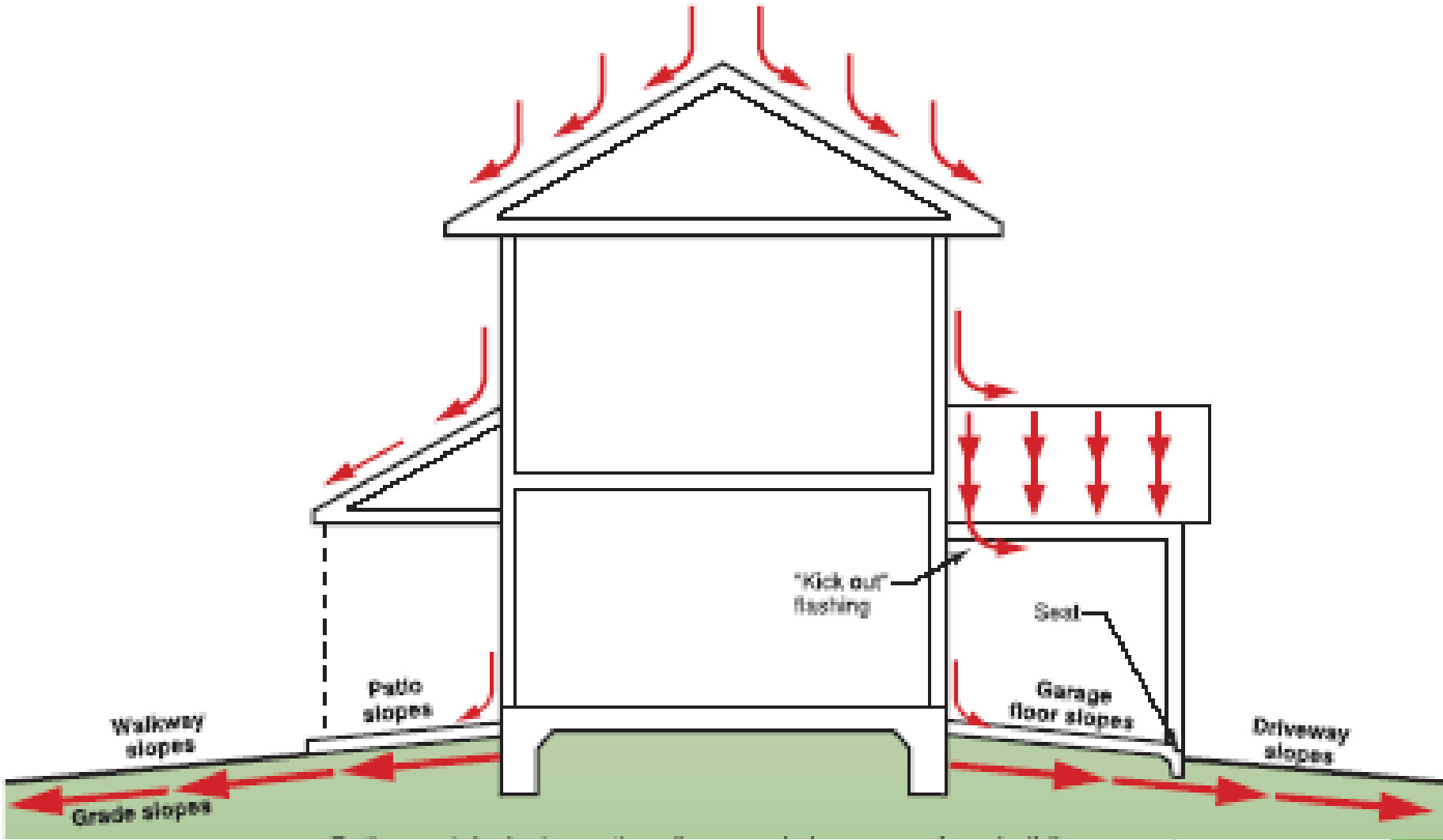
SIDING MATERIAL	NOMINAL THICKNESS (inches)	JOINT TREATMENT	TYPE OF SUPPORTS FOR THE SIDING MATERIAL AND FASTENERS						
			Wood or wood structural panel sheathing into stud	Fiberboard sheathing into stud	Gypsum sheathing into stud	Foam plastic sheathing into stud <sup>d</sup>	Direct to studs	Number or spacing of fasteners	
Anchored veneer: brick, concrete, masonry or stone (see Section R703.8)	2	Section R703.8	Section R703.8						
Adhered veneer: concrete, stone or masonry (see Section R703.12)	—	Section R703.12	Section R703.12						
Fiber cement siding	Panel siding (see Section R703.10.1)	5/16	Section R703.10.1	6d common (2" x 0.113")	6d common (2" x 0.113")	6d common (2" x 0.113")	6d common (2" x 0.113")	4d common (1 1/2" x 0.099")	6" panel edges 12" inter. sup.
	Lap siding (see Section R703.10.2)	5/16	Section R703.10.2	6d common (2" x 0.113")	6d common (2" x 0.113")	6d common (2" x 0.113")	6d common (2" x 0.113")	6d common (2" x 0.113") or 11 gage roofing nail	Note f
Hardboard panel siding (see Section R703.5)	7/16	—	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	0.120" nail (shank) with 0.225" head	6" panel edges 12" inter. sup.d
Hardboard lap siding (see Section R703.5)	7/16	Note e	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	0.099" nail (shank) with 0.240" head	Same as stud spacing 2 per bearing
Horizontal aluminum <sup>g</sup>	Without insulation	0.019 <sup>b</sup>	Lap	Siding nail 1 1/2" x 0.120"	Siding nail 2" x 0.120"	Siding nail 2" x 0.120"	Siding nail <sup>h</sup> 1 1/2" x 0.120"	Not allowed	Same as stud spacing
		0.024	Lap	Siding nail 1 1/2" x 0.120"	Siding nail 2" x 0.120"	Siding nail 2" x 0.120"	Siding nail <sup>h</sup> 1 1/2" x 0.120"	Not allowed	
	With insulation	0.019	Lap	Siding nail 1 1/2" x 0.120"	Siding nail 2 1/2" x 0.120"	Siding nail 2 1/2" x 0.120"	Siding nail <sup>h</sup> 1 1/2" x 0.120"	Siding nail 1 1/2" x 0.120"	
Insulated vinyl siding <sup>l</sup>	0.035 (vinyl siding layer only)	Lap	0.120 nail (shank) with a 0.313 head or 16-gage crown <sup>k, l</sup>	0.120 nail (shank) with a 0.313 head or 16-gage crown <sup>l</sup>	0.120 nail (shank) with a 0.313 head or 16-gage crown <sup>l</sup>	0.120 nail (shank) with a 0.313 head or 16-gage crown <sup>l</sup>	0.120 nail (shank) with a 0.313 head Section R703.11.2	Not allowed	16 inches on center or specified by manufacturer instructions, test report or other sections of this code
Particleboard panels	3/8	—	6d box nail (2" x 0.099")	6d box nail (2" x 0.099")	6d box nail (2" x 0.099")	6d box nail (2" x 0.099")	6d box nail (2" x 0.099")	Not allowed	6" panel edges 12" inter. sup.
	1/2	—	6d box nail (2" x 0.099")	6d box nail (2" x 0.099")	6d box nail (2" x 0.099")	6d box nail (2" x 0.099")	6d box nail (2" x 0.099")		
	5/8	—	6d box nail (2" x 0.099")	8d box nail (2 1/2" x 0.113")	8d box nail (2 1/2" x 0.113")	6d box nail (2" x 0.099")	6d box nail (2" x 0.099")		
Polypropylene siding <sup>h</sup>	Not applicable	Lap	Section 703.14.1	Section 703.14.1	Section 703.14.1	Section 703.14.1	Section 703.14.1	Not allowed	As specified by the manufacturer instructions, test report or other sections of this code
Steel <sup>c</sup>	29 ga.	Lap	Siding nail (1 3/4" x 0.113") Staple-1 3/4	Siding nail (2 3/4" x 0.113") Staple-2 1/2	Siding nail (2 1/2" x 0.113") Staple-2 1/4	Siding nail (1 3/4" x 0.113") Staple-1 3/4	Not allowed	Same as stud spacing	
			0.120" nail(shank) with a 0.313"	0.120" nail(shank) with a 0.313"	0.120" nail(shank) with a 0.313"	0.120" nail(shank) with			



# Everything Has to Work



# Everything...



# Water Management Fundamentals

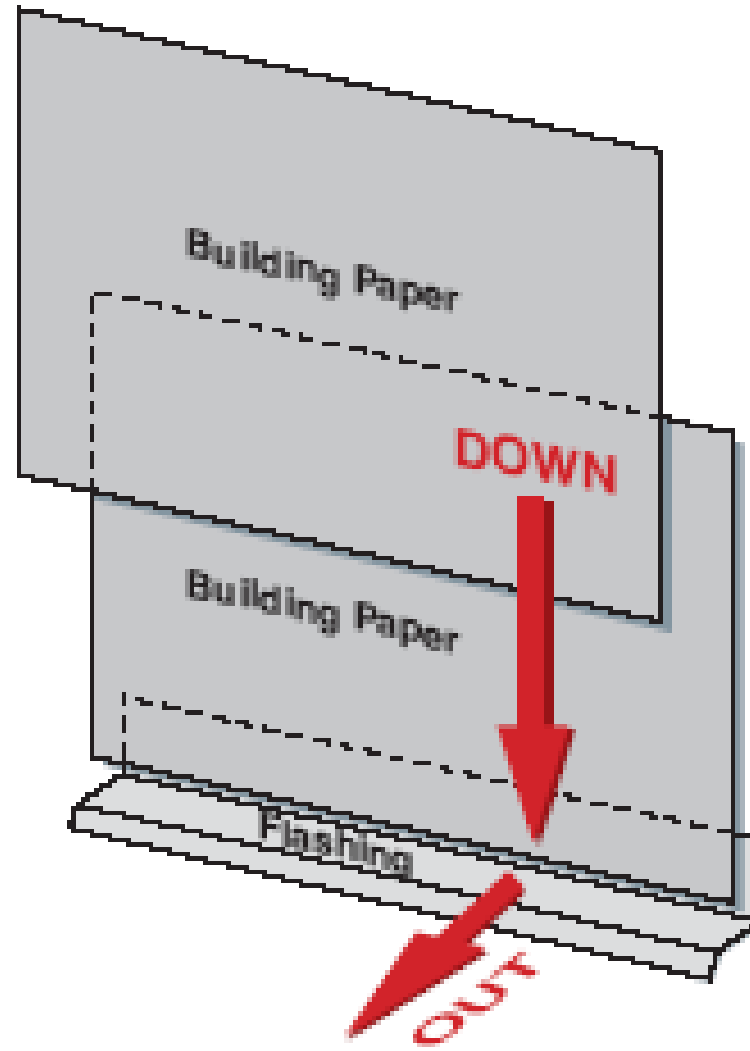
**Builders are used to applying basic water management principles daily**

Shingles

Building paper

**Where do we mess up?**

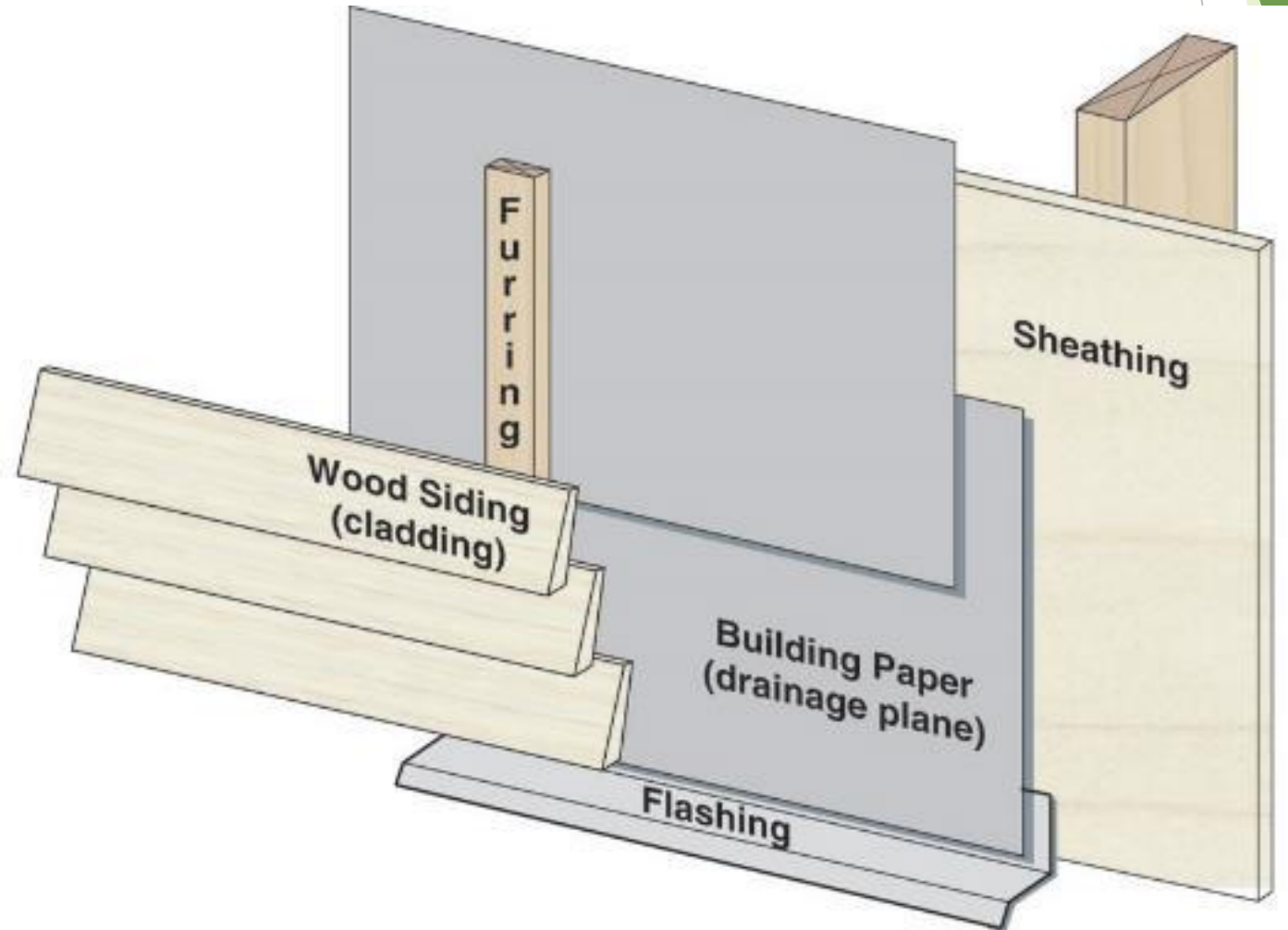
Almost always at the joints and connections where different things come together



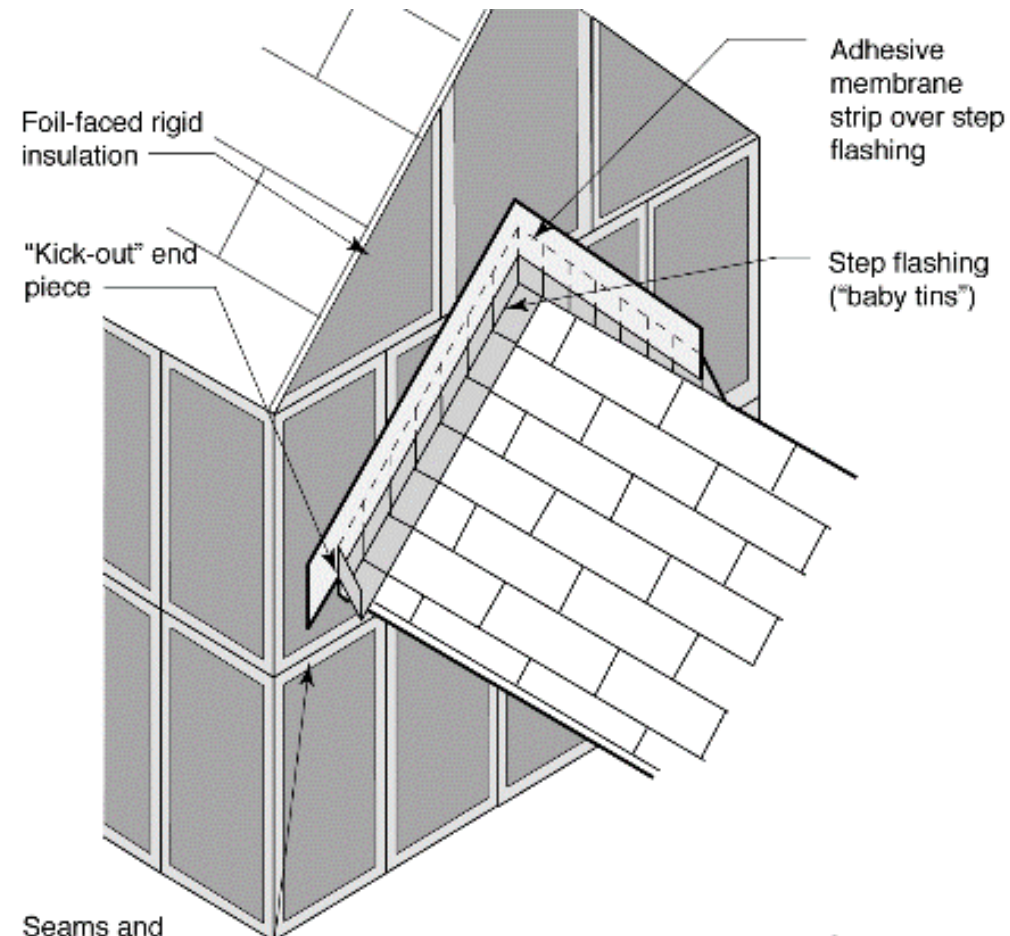
# Water Management Simplicity

Let's look at the  
basic components  
of wall water  
management.

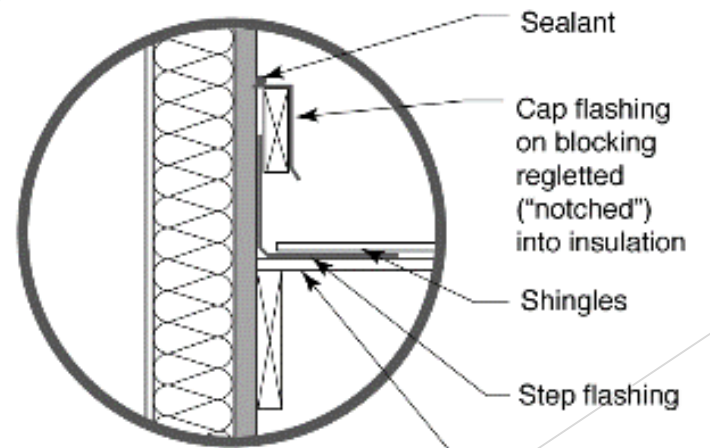
One Solution...







Seams and corners taped to provide drainage plane continuity



**Alternate Flashing Detail**

# 40+ HOUSEWRAPS!

## **BBA Non-Wovens: Reemay Inc.**

Typar Housewrap

## **Pactiv**

GreenGuard® Classic Wrap

GreenGuard® Value Wrap

GreenGuard® Ultra

GreenGuard® Raindrop

Top Choice

## **Owens Corning**

PinkWrap®

PinkWrap® Plus

## **Celotex Corp.**

Tuffwrap®

Tuff Weather Wrap

## **Fabrene Inc./Dow/Canadian**

Air-Guard®

## **Abitibi-Price/Sto-Cote Products**

Pro-Wrap & Air Seal® Housewraps

## **Firstline Corporation**

Firstwrap® Air Barrier

Firstwrap® Housewrap

Firstwrap® Weather Barrier

Perma Wrap

Global Guard

## **John Manville, et al**

Valeron® Film

## **DuPont**

Tyvek® HomeWrap®

Tyvek® StuccoWrap®

Tyvek® DrainWrap®

Tyvek® CommercialWrap®

## **Ludlow Coated Products**

Rwrap®

Barricade®

Energy-Wrap Housewrap

Air Stop

Air Stop II

Weather Trek

## **CS Fabric/Protecto Wrap Co.**

PrimeWrap®

Hi-Q Wrap

Energy Housewrap

Dri-Shield Housewrap

Marvel Guard

Ply Dry

Protecto-Wrap

## **Dow**

Weathermate®

Weathermate® Plus

## **Many Manufacturers**

#15 Felt



# Window Leaks

**JUMP!!**



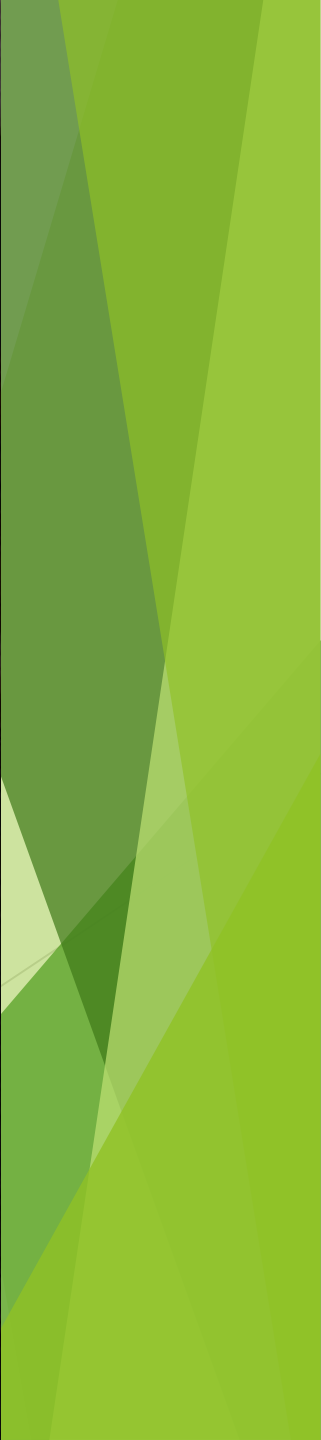












# But First - Gimme A Break!



# Water Management (Drainage Plane)

Energy Code - N/A Vapor Retarder ONLY

Residential - Chapter 7

### Exterior Conditions

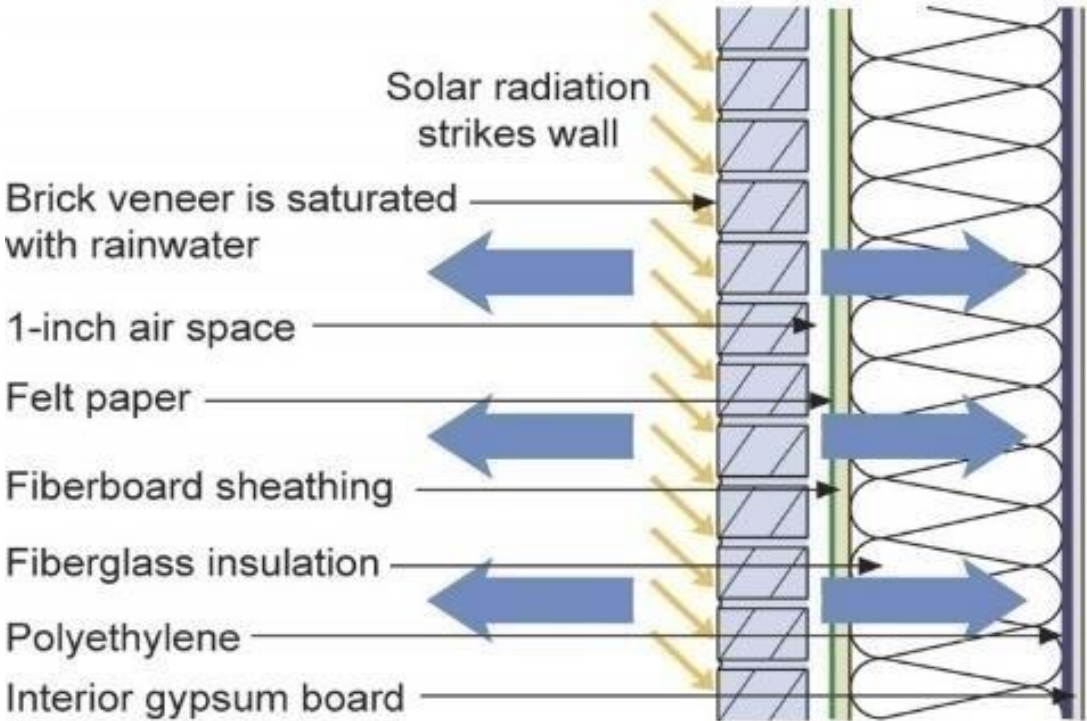
Temperature: 80°F  
Relative humidity: 75%  
Vapor pressure: 2.49 kPa

### Conditions within Cavity:

Temperature: 120°F  
Relative humidity: 100%  
Vapor pressure: 11.74 kPa

### Interior Conditions

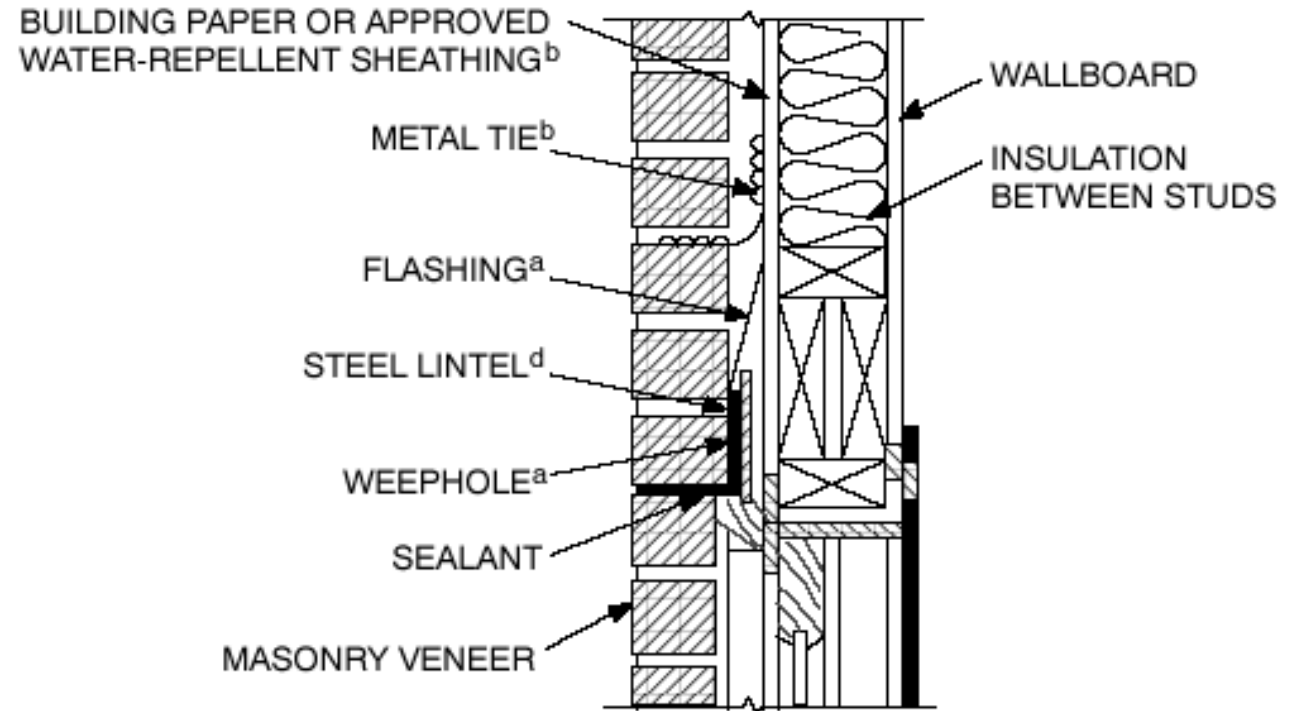
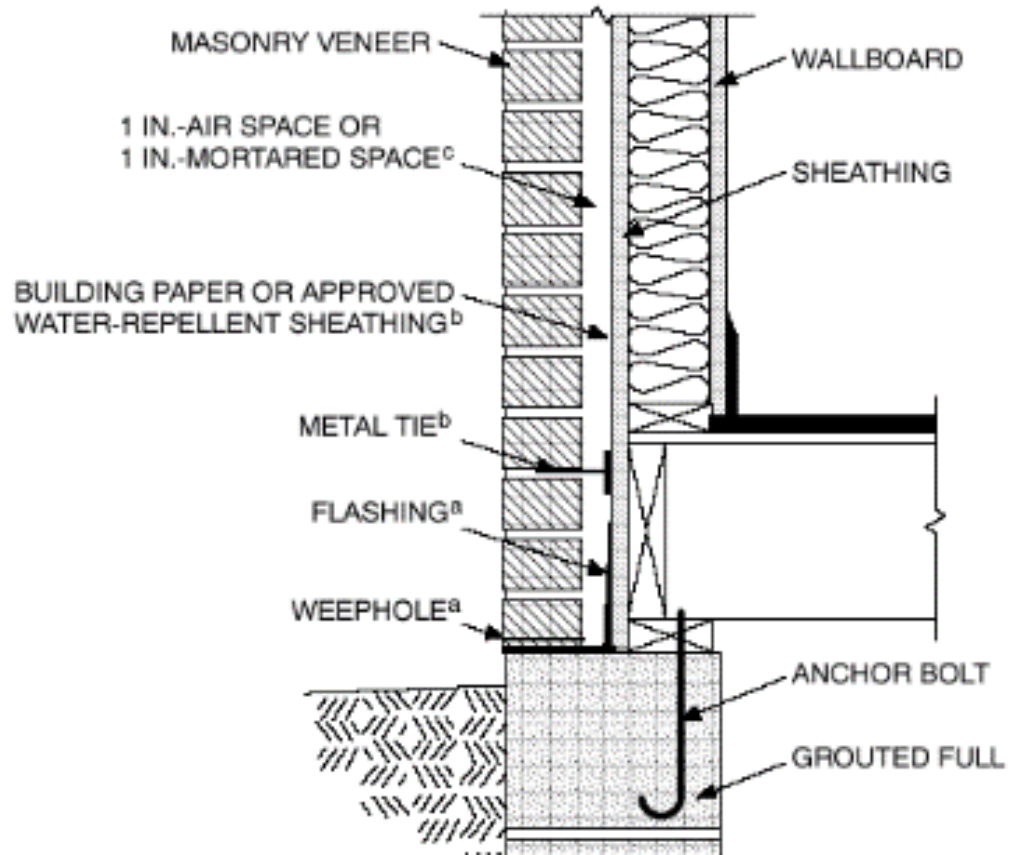
Temperature: 75°F  
Relative humidity: 60%  
Vapor pressure: 1.82 kPa



Vapor is driven both inward and outward by a high vapor pressure differential between the brick and the interior and the brick and the exterior.

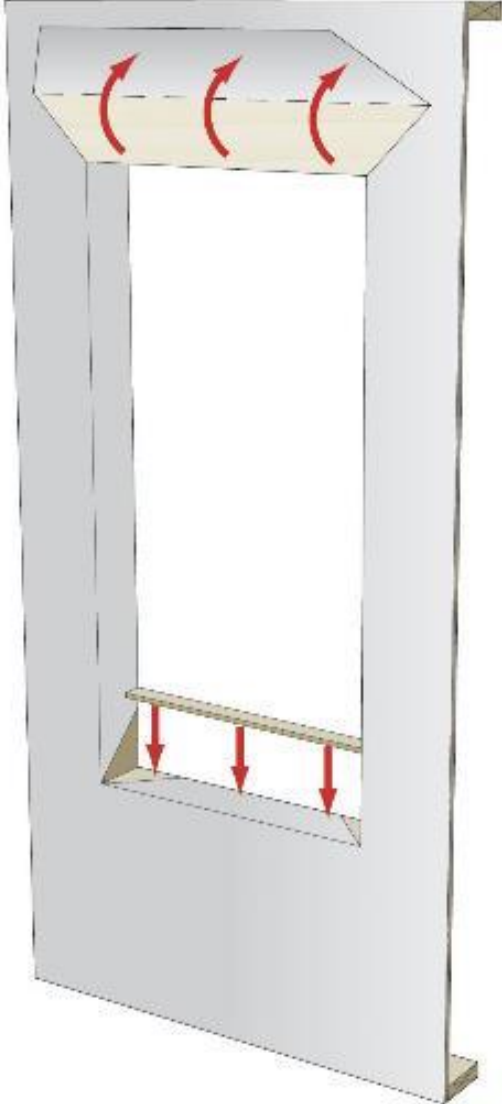
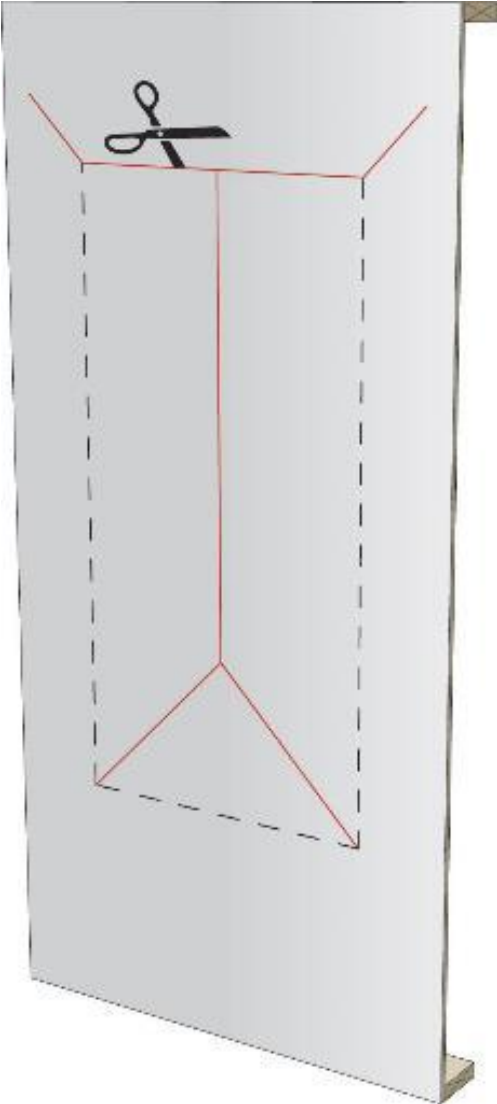
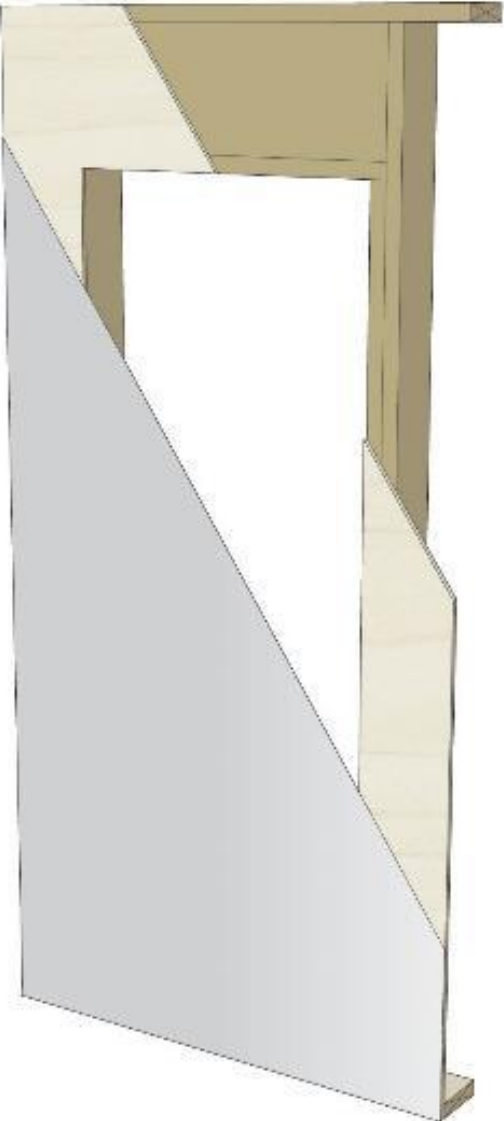
# Water Management (Drainage Plane)

Energy Code - N/A Vapor Retarder ONLY  
Residential - Chapter 7

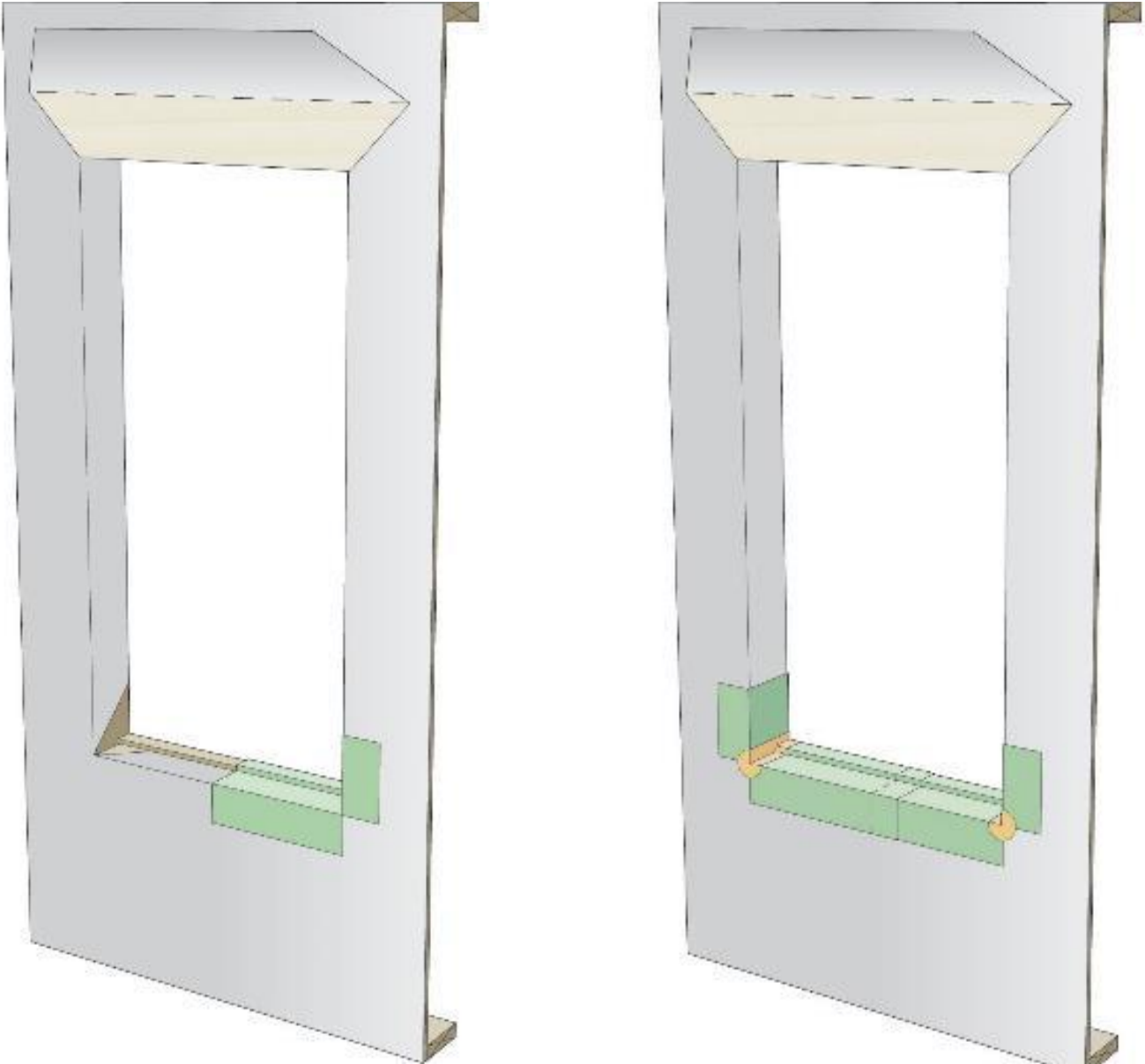




# Deal With Window and Door Penetrations!



# Preparing for the Window...

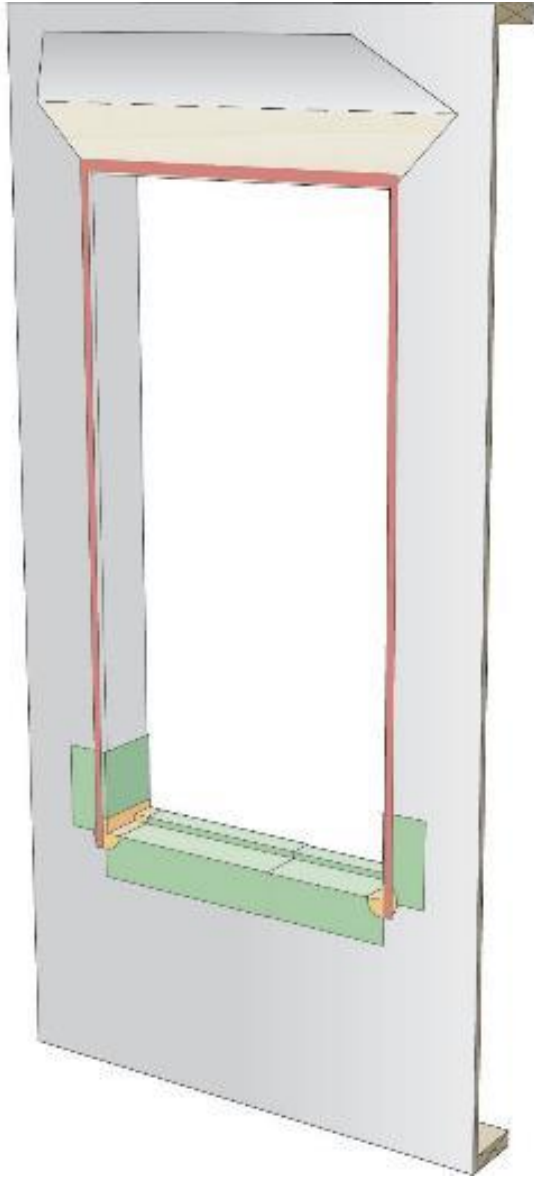


# Sill Flashing

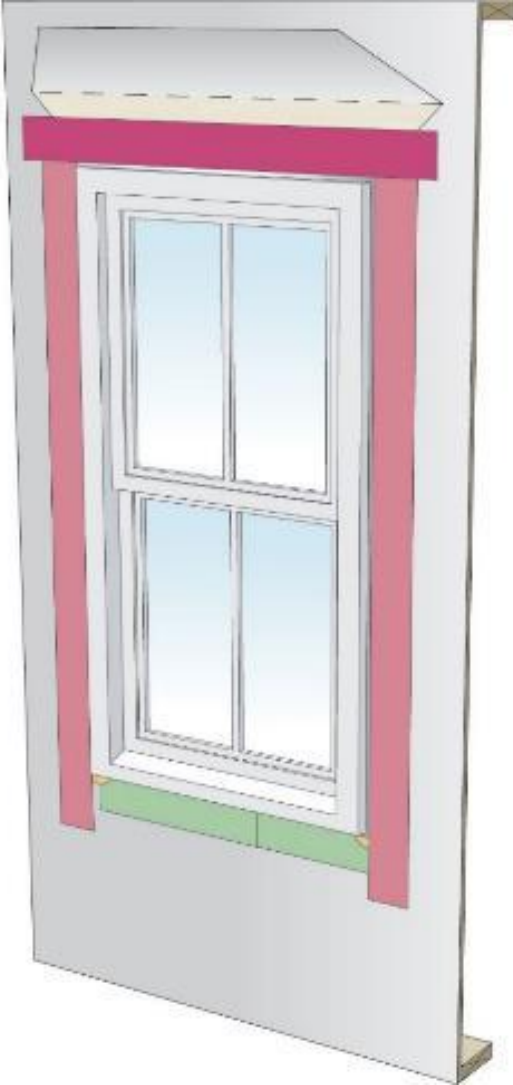
Can use continuous or multi-piece flashing approach  
Key is integration into whole wall system



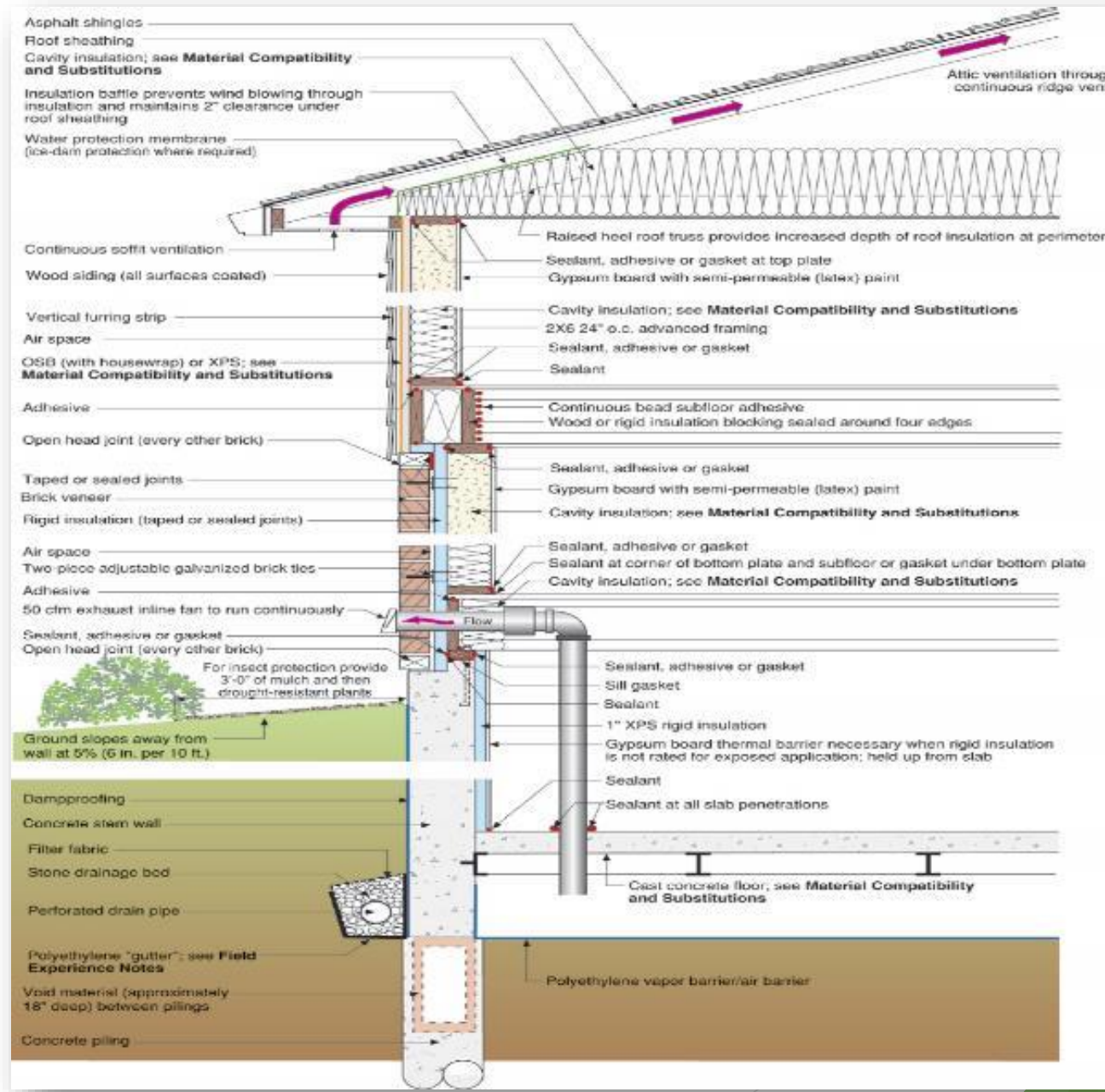
# Integrate Windows



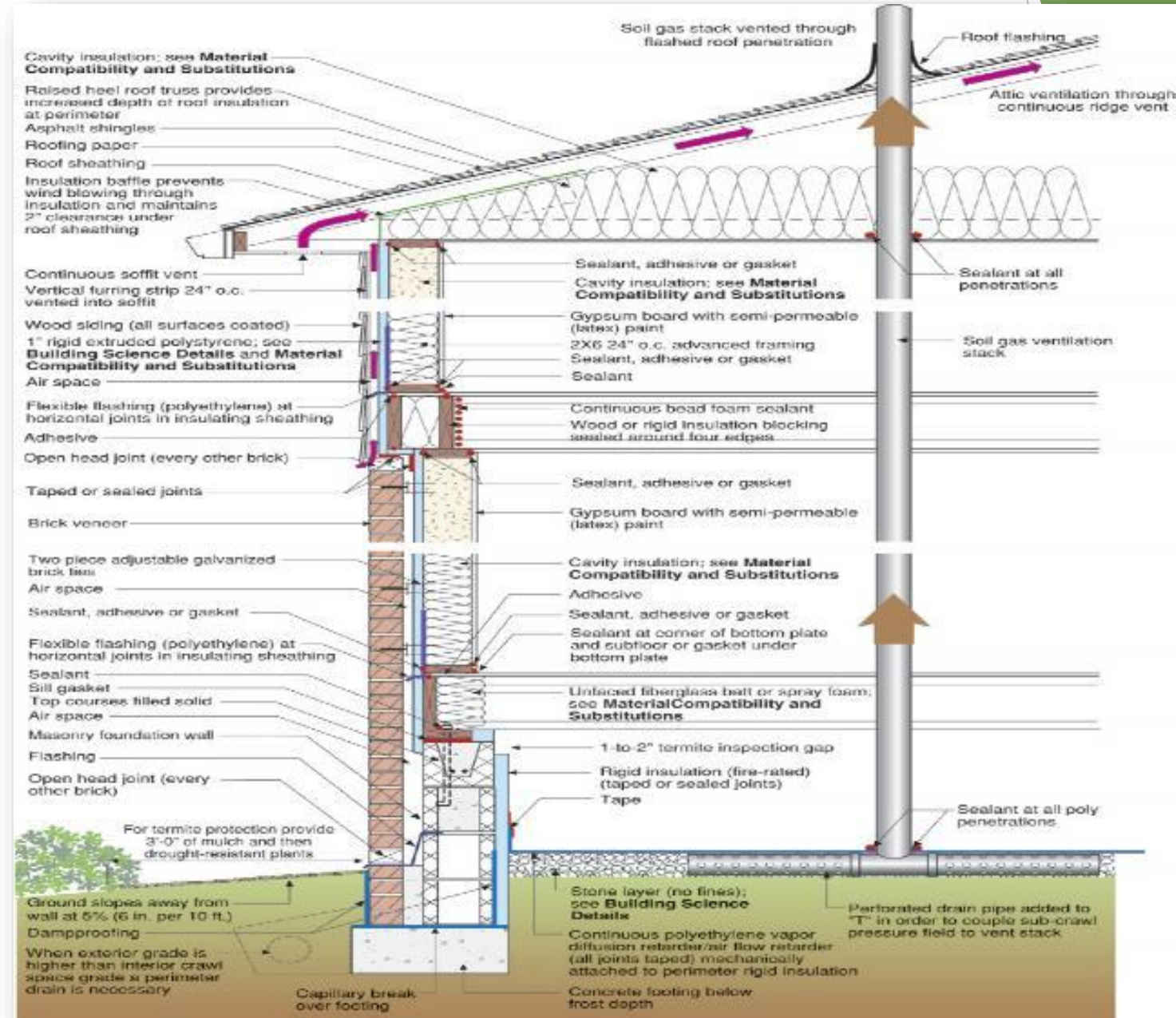
# Continuous Drainage Plane



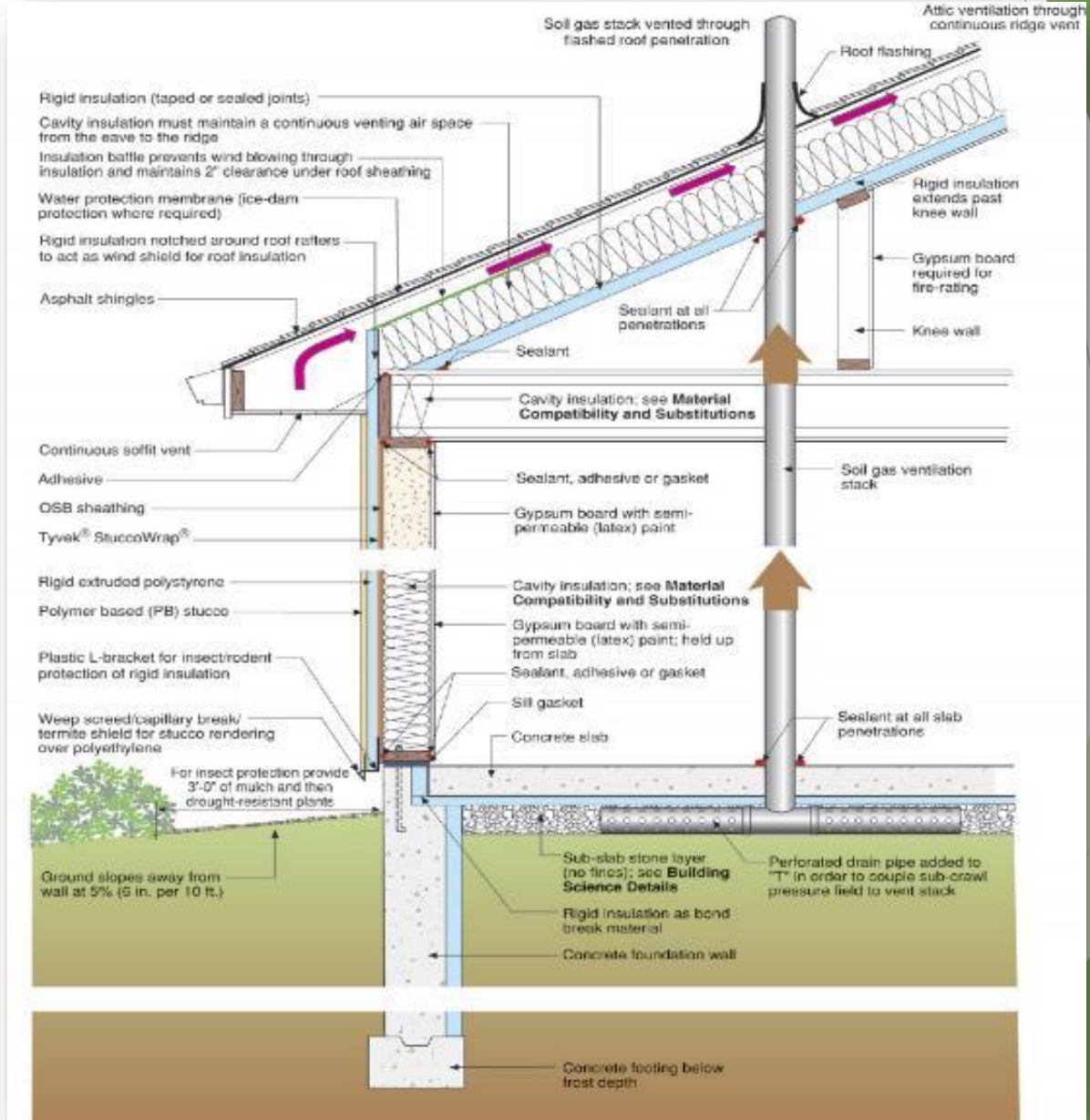
# The "Denver"



# The "Chicago"



# The “Minneapolis”





# Advanced Framing (OVE)

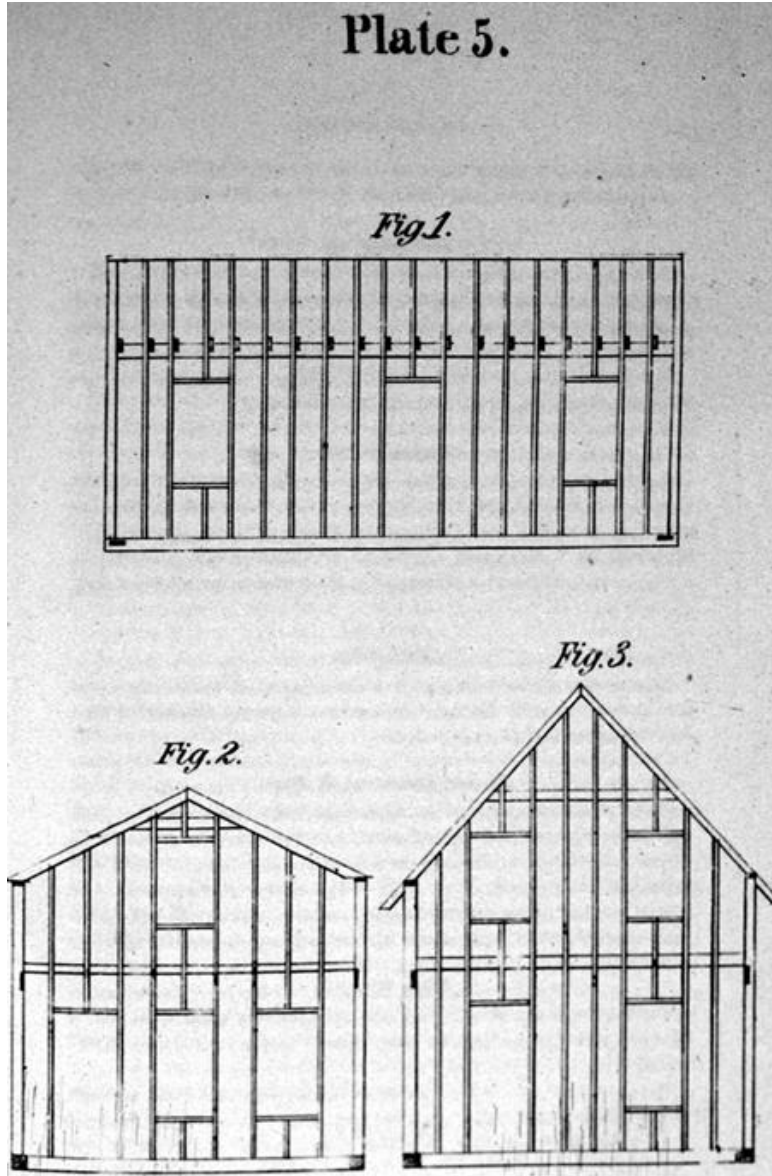
Energy - N/A

Residential - Chapter 6

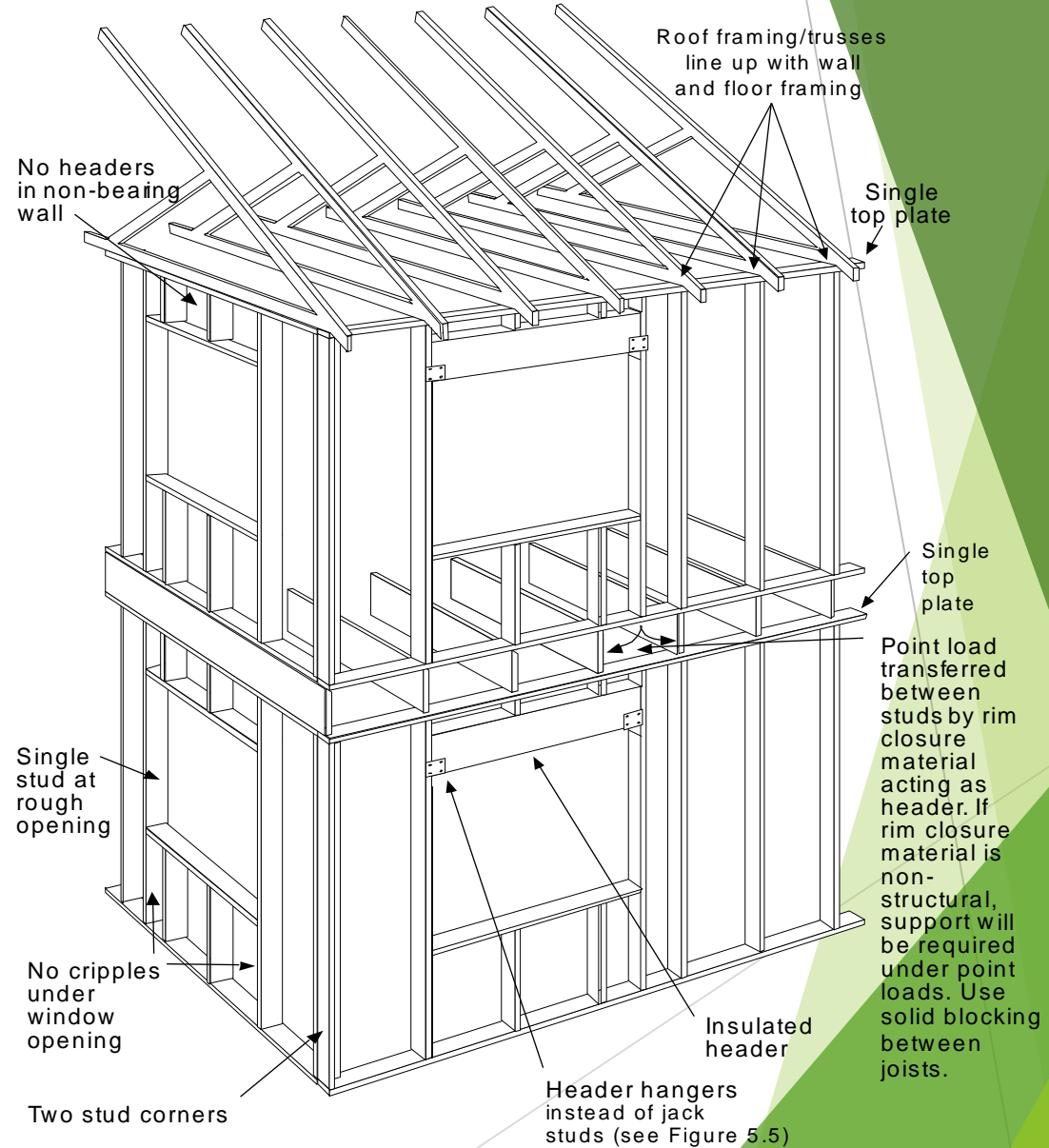
- Residential Code - Chapter 601 “Wall Construction”, 602 “Wall Covering”, Table 502.5 (1) “Girder/Header Spans”
- 602.3.2 allows single Top Plate if steel plate is used at joints, or lintels adequately also tied with steel bridges or ties
- 602.3.3 Allows bearing stud wall to be 24” on center if loads above bear within 5” of studs below (stack framing)
- 602.5 Allows Interior Non-load bearing walls to be 2x3
- 602.7.2 - Allows Non-Load bearing headers in non load bearing walls
- 602.10.3 - Allows Braced Wall construction with either let-in wood bracing OR steel strapping as alternate, or Structural Panel sheathing at corners
- Table 502.5 (1) - Allows Header Hangers  
Sounds Like a Perceived, not Real Barrier!

# Using Lumber Efficiently

Carpentry Made Easy, William Bell, 1858



EEBA Builder's Guide, Lstiburek, 2001





**This wall has been prepared for the next phase of insulation and drywall**



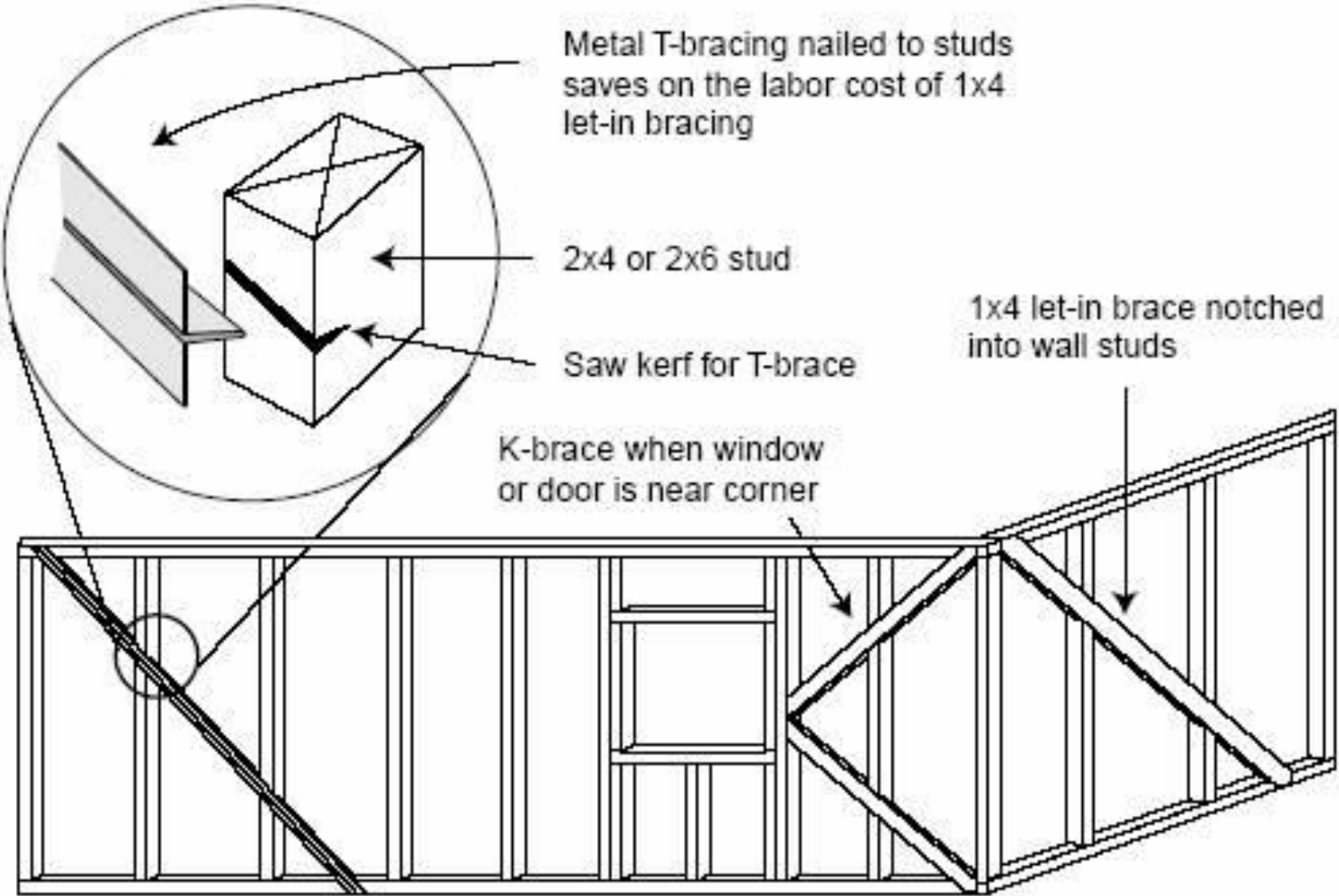
# Advanced Framing (OVE)

Best Practice - Using Lumber More Efficiently

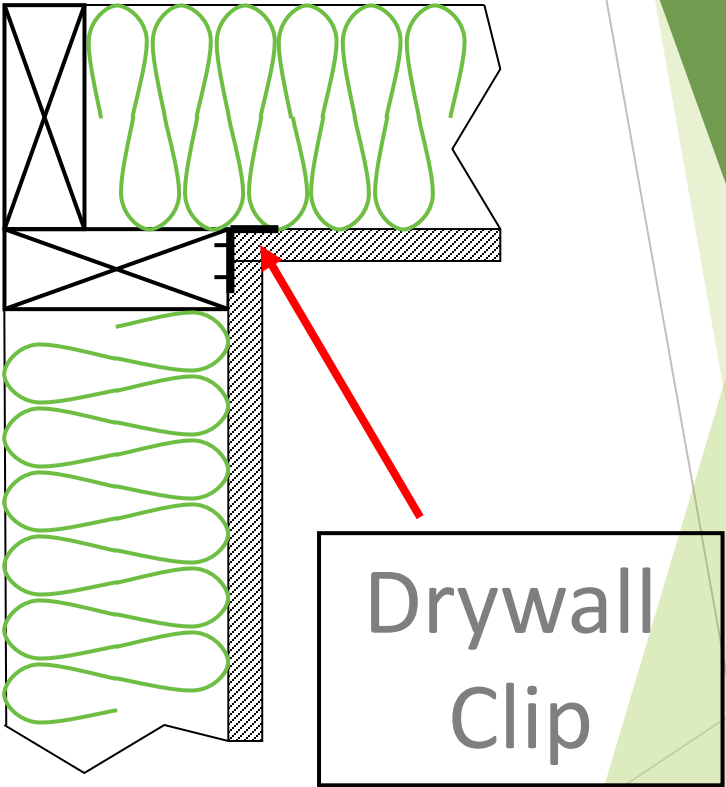
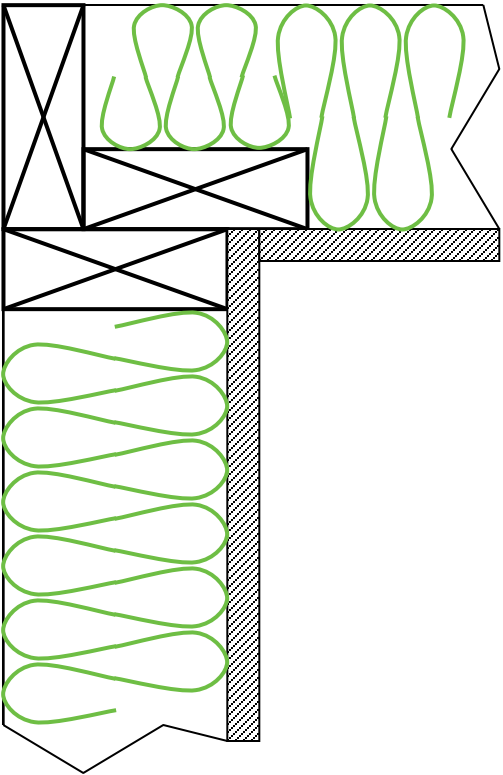
Is This Getting It Done?



# Bracing and Insulation



# Three and Two Stud Corners



# Corner Framing Example

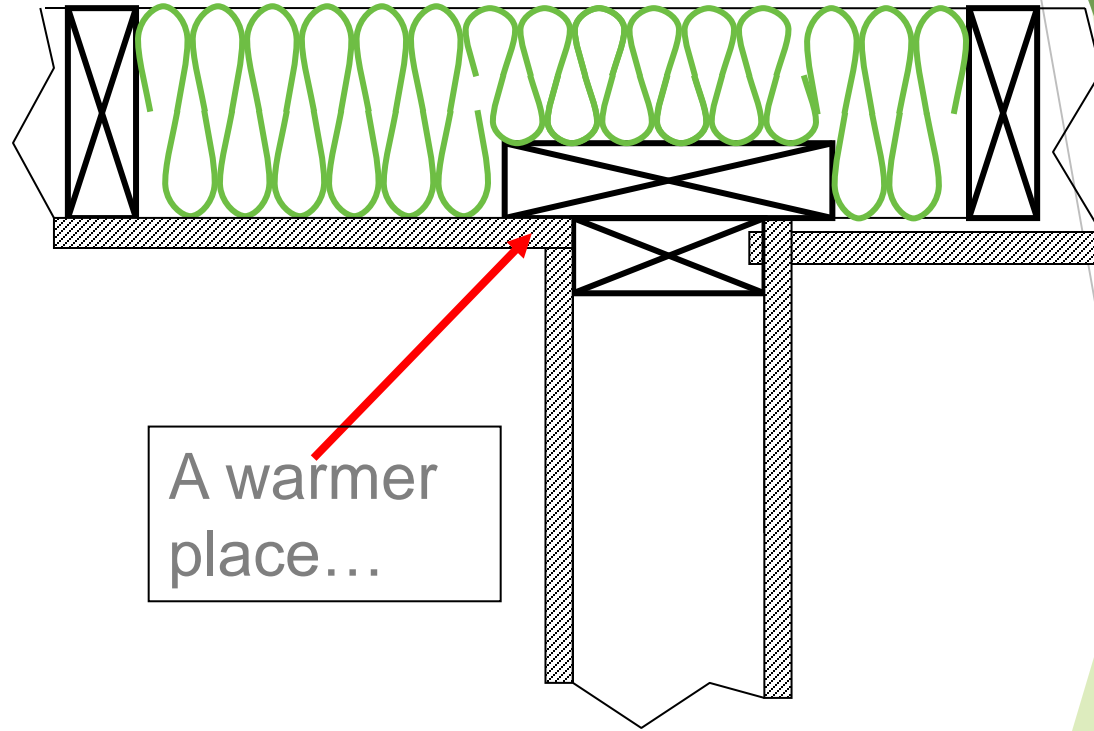




# Drywall Backing at Partitions

## Backing made of:

- Larger 2x
- Plywood
- Horizontal ladder blocking
- Or drywall clips



# Ladder Framing



# DETAILS – OVE FRAMING

- minimized cripples
- open web floor truss
- insulating sheathing
- modular dimensions
- 24-inch OC 2X6 in-line
- 2-stud corners
- load-tuned headers
- single top plate



# Advanced Framing: Small



1,200 sq. ft. single story

# Advanced Framing: Large



8,000 sq. ft. 2-story w/walkout

# Whole House Material Savings

2x4 16	2x6 16	2x6 24	2x6 Adv.Fr
276 Studs 940 Bd Ft <b>\$504</b>	276 Studs 1475 Bd Ft <b>\$798</b>	243 Studs 1289 Bd Ft <b>\$696</b>	168 Studs 905 Bd Ft <b>\$471</b>
OSB R-9 <b>\$1138</b>	OSB R-13 <b>\$1432</b>	OSB R-14 <b>\$1350</b>	OSB R-15 <b>\$1122</b>
1" XPS R-12 <b>\$1094</b>	1" XPS R-18 <b>\$1388</b>	1" XPS R-18 <b>\$1346</b>	1" XPS R-20 <b>\$1157</b>

*Note: These values do not include any labor savings. Material usage only!*



- ▶ Keep the dough rolling

# Crawlspaces: To Vent or NOT to Vent

Energy Code - Chapter 4

Residential - Chapter 4

## **Energy Code - Section 402.2.11 Crawlspace Walls**

Allows insulation of Crawlspace sidewalls where crawlspace is NOT ventilated to the outside

## **Residential Code - 408.1 Under Floor Space**

Requires Mechanical Ventilation to inside space of  
1 CFM per 50 ft<sup>2</sup>

Requires Vapor retarder on ground

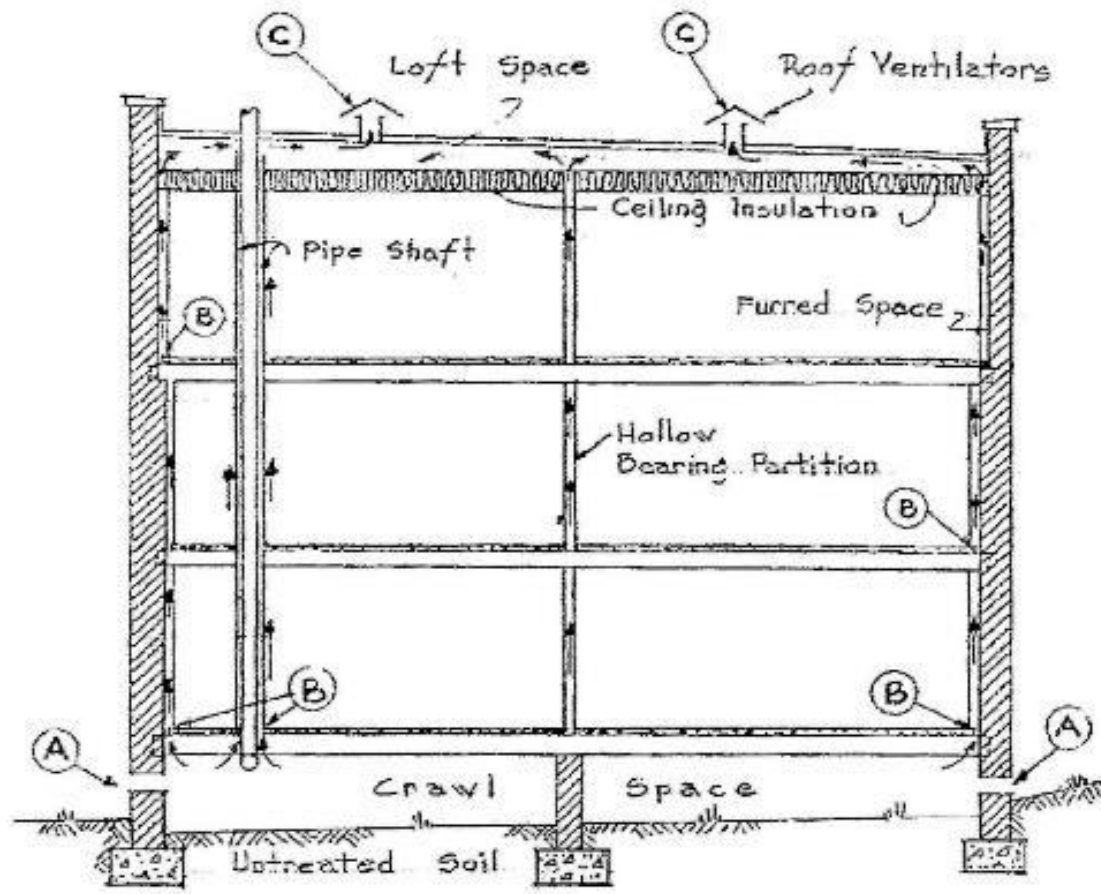
**Another PERCEIVED Code Barrier, but very real if CEO doesn't like or understand it**



# Crawlspaces and Basements

- **Dr. Bill Rose, University of Illinois Small Buildings Research Council**
- **Exposed soil is a Major source of Moisture in the home.**
- **100 Lbs. (12.2 gals.) of water per 1,000 SF of dry exposed soil per day!**
- **Whole Family = 8 gals./day**
- **Each 1,000 SF of soil equals 150% increase in moisture contribution!**

# Crawlspaces: To Vent or NOT to Vent Best Practice



- Ⓐ = Inadequate wall ventilation:
- Ⓑ = Openings in floor  $\frac{1}{8}'' \pm$ , continuous
- Ⓒ = Roof ventilation misplaced unless vents are also in side walls above top ceiling floor.
- → Arrows indicate path of warm humid air

# Is This a Good Idea?



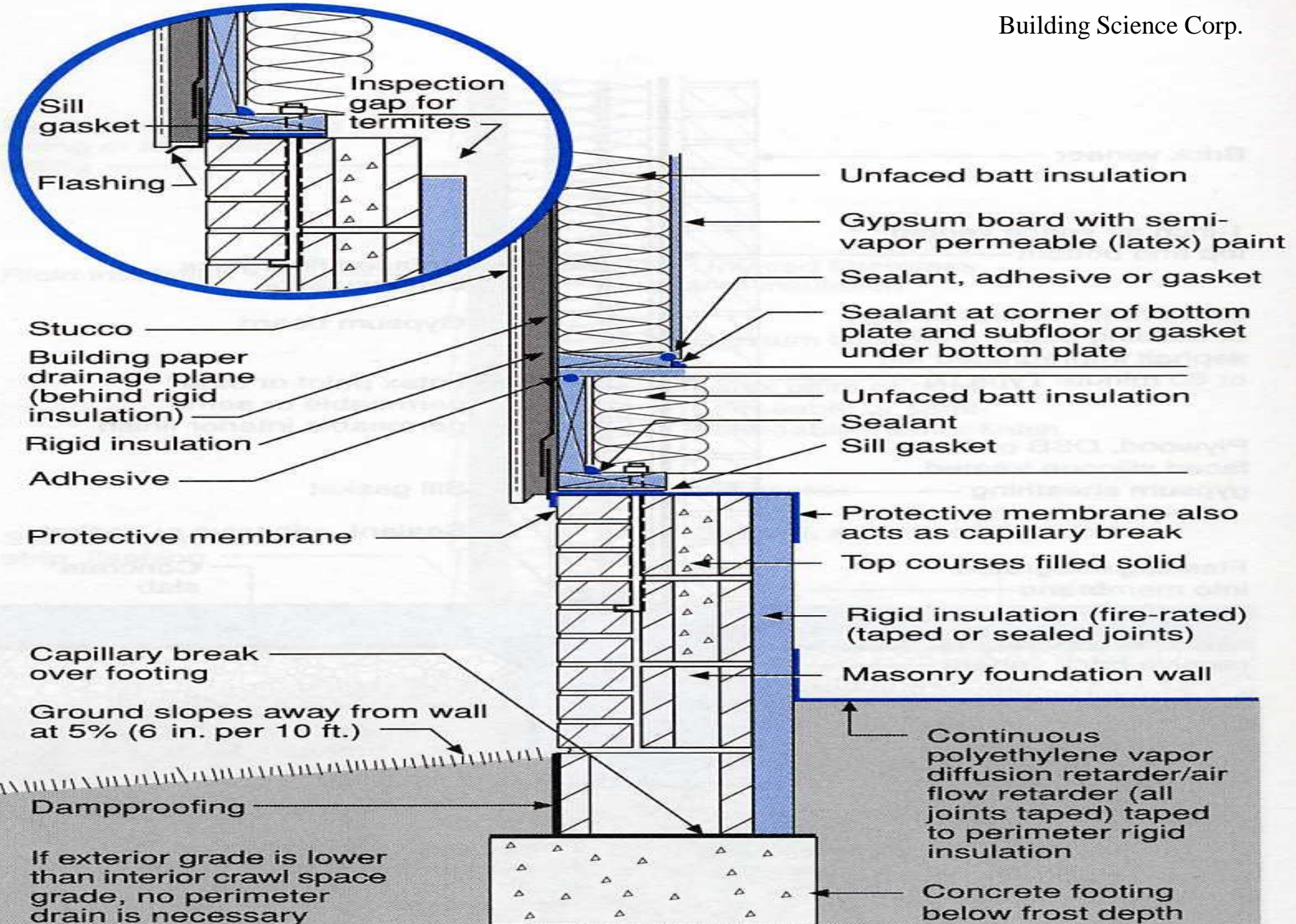
# Are vents helping?



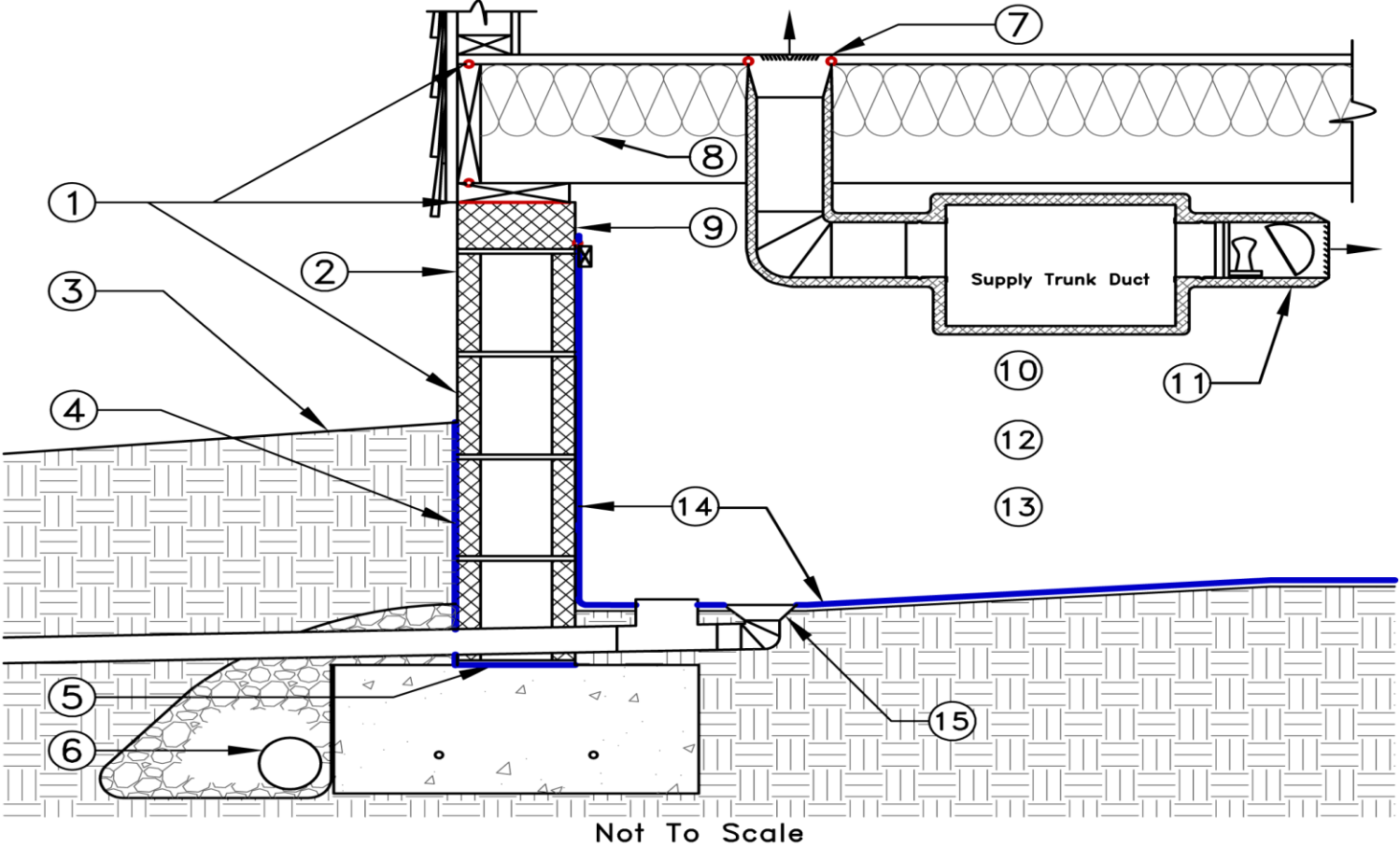
# Vented Crawlspace

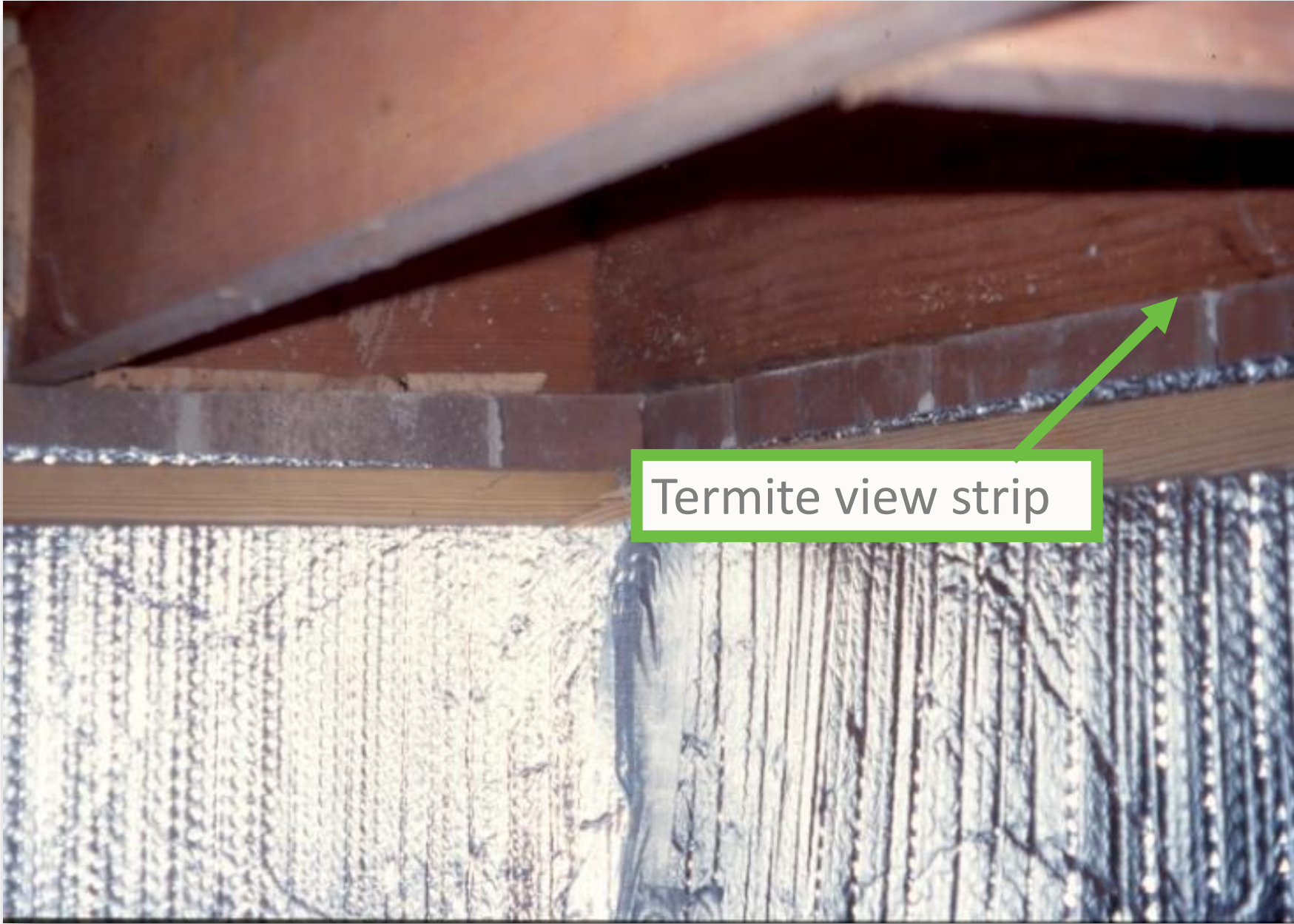


**Alternative Detail**



# Crawlspaces: To Vent or NOT to Vent Best Practice

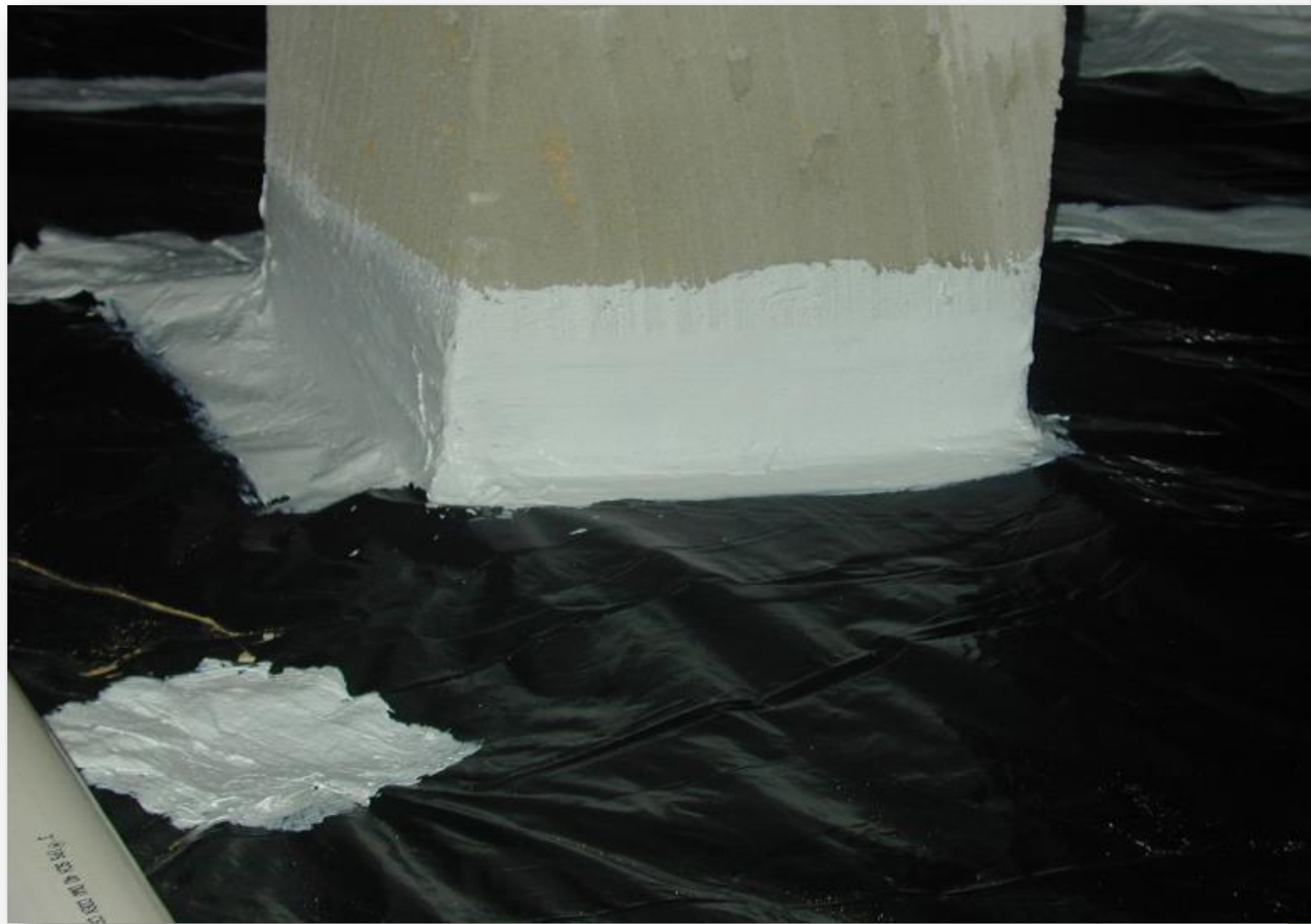




Termite view strip

Photo by the Healthy Building Company





1 23 23 23 23 23



Termite view strip



# Unvented Crawlspace: Fire Code Issues

- National Evaluation Service - ER-699 allows use of (DOW) foam board insulation uncovered if;
- Entrance for utilities only
- No interconnection to other spaces
- Air not circulated to other spaces
- Foam plastic < 1" or 2" (density driven)
- Meets venting (or no venting in this case, IRC)
- In combustible construction (most all Residential) only

# Air Sealing

## Energy Code - Chapter 4

### Residential Code - Essentially Mirrored

#### **Energy Code - 402.4.1 “Air sealing and Insulation”**

Requires Window and Door tested leakage Minimums (NFRC Label)

Caulking and Sealants Somewhat ambiguous; “Exterior Joints, seams, or penetrations in building envelope...” (...tubs, showers, penetrations...”

“shall allow for differential expansion...”

“...Covered with Vapor-permeable house-wrap...”

NEWER AIR LEAKAGE CHECKLIST!!

NOTHING about interior spaces, focuses on ENVELOPE

#### **Residential Code - Mirrors Energy**

Fire Retardency –

R602 GENERALLY requires fire retardency if through a fire rated separation, not elsewhere

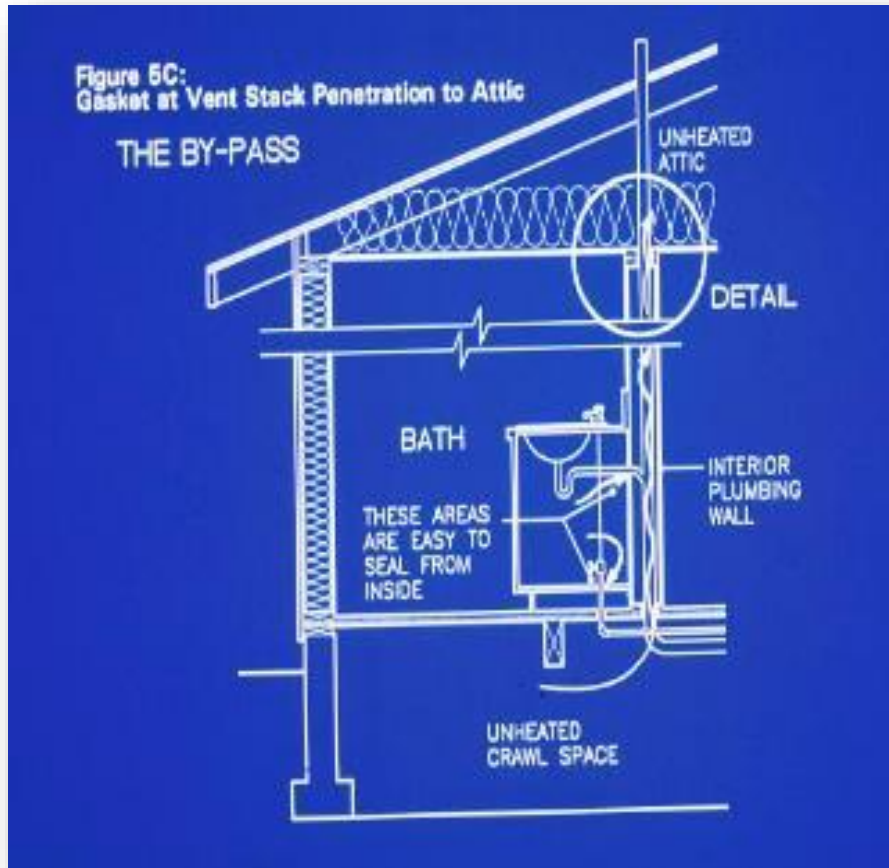
\*R302.11, duct penetration of garage/house walls is the only such penetration

**Let’s ask the Code Pros...**

# Who Needs Air Sealing?



# Teach The Subs...



**to seal the penetrations  
they make!!**

# Air Sealing Best Practice

Behind tubs



# Plumbing & Electrical...





# Roof/Wall Intersections



# Chimney Shafts and Penetrations



# Cantilevers, Bay Windows, Etc.



# Projections



# Blower Door Testing

Basic air tightness diagnostics

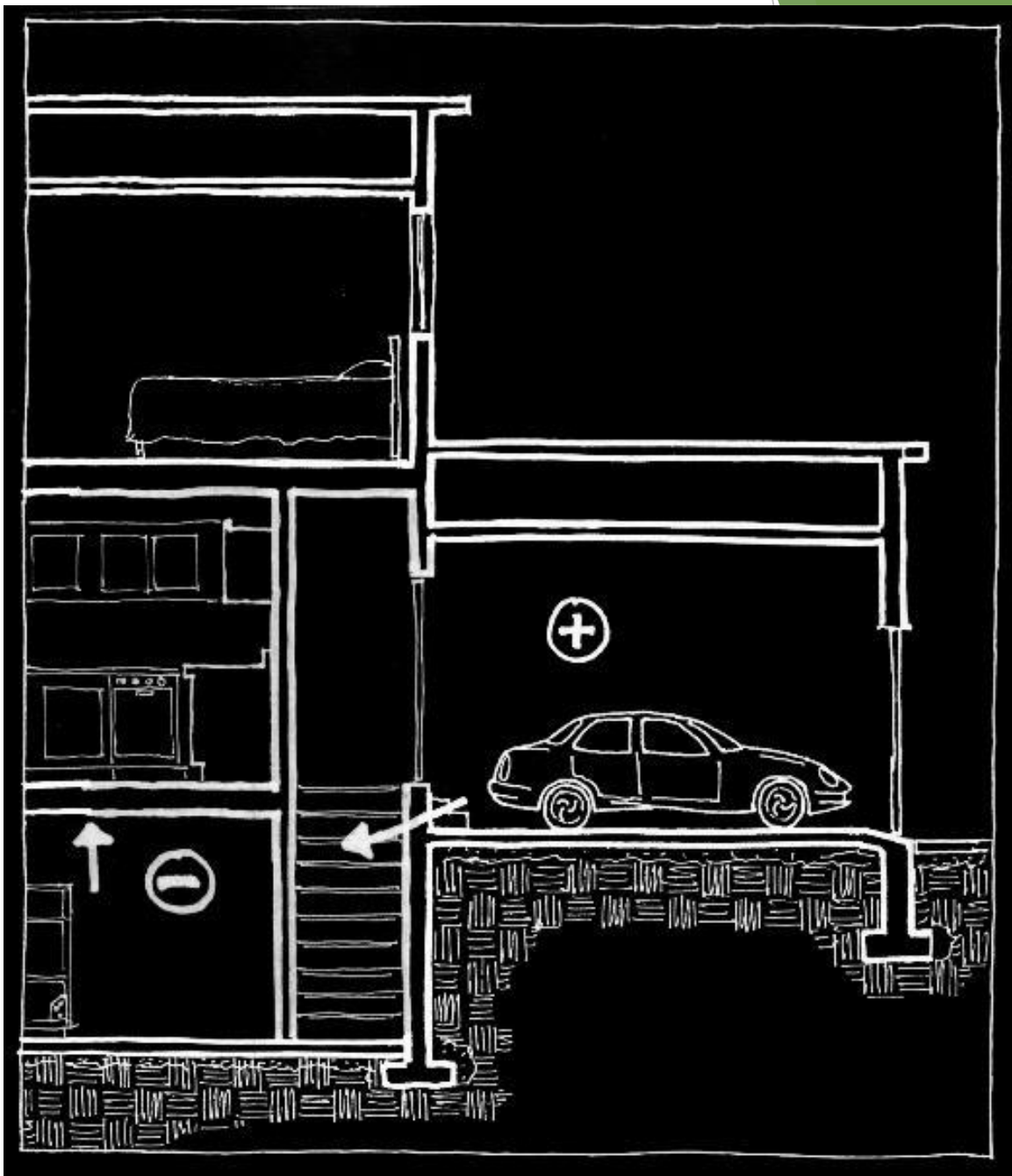


One Approach...

“Own your own holes”



Attached or “built over” garages may shelter the conditioned space thermally, but not in terms of air quality-- air sealing here is critical.



# Duct Sealing - What the Code Says:

Energy - Chapter 403

Residential- Chapter 16

## Energy Code - Chapter 403.3.2, “Sealing...”

“All joints. transverse seams...”

Sealed with Tapes and Mastics listed in accordance with  
UL181A or B

Unlisted Tapes Not Permitted

## Residential Code - Chapter 16 “Duct Systems”

Essentially Mirrors Energy – more detail prov





# DUCTS – THE NEXT BIG HOLE

**Builders don't think about them!**

**Builder savings?**

**Yes! Reduce callbacks with:**

Improved duct performance

Better duct insulation

Joint sealing

More Detail also in RCNYS-2020 M1504



# How Big is the Duct?

▶ Well, it depends...



# Multiple Duct Types

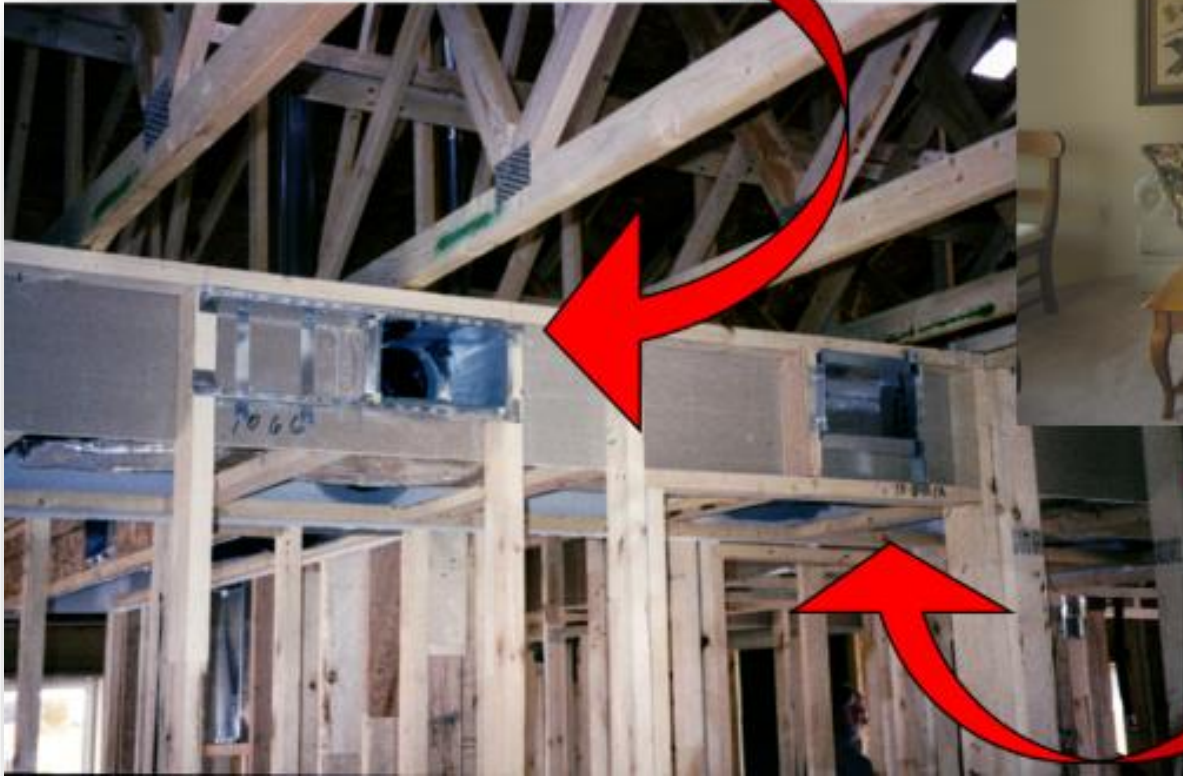


# Seal Your Ducts!



# Ducts Inside Conditioned Space

Supply in dropped soffit



Transfer grille

# Big Duct Holes and the Code



# What's Missing?



# Duct Sealing (or Lack Thereof)





But First...



# Fresh Air Ventilation



# **NY Residential Code Ventilation Requirements – RCNYS-2020**

- **Primarily in RCNYS-2020, some and ECCCCNYS – 2020**
- **Energy Code requires efficient, quiet fans capable of 100% run time**
- **Res Code – covered in Sec 1504 Mech. Ventilation**
- **Energy Code – fan efficacy covered in Sec R403.6**
- **Does NOT reference ASHRAE 62.2, BUT**
- **Based on 62.2, various versions**

# NYS Residential Code Ventilation Requirements...

## **ECCCNYS–2020 requires Sec R403.6 & Table)**

- Fans must be energy efficient
- **Whole-house mechanical ventilation system**

## **RCNYS-2020 – Sec. 1505.4 & Tables**

- **Whole-house mechanical ventilation system**
- **CAN** be exhaust-only, supply-only, or balanced
- *IMPLIED that makeup air be supplied*
- **Bath Fans CAN** be part of the system for exhaust
- **Must have automatic control with accessible shutoff**
- **Can be operated full time or intermittently**

# NYS Residential Code Ventilation Requirements...

## Whole-house mechanical ventilation system

“An exhaust system, supply system, or combination thereof that is designed to mechanically exchange indoor air for outdoor air where operating continuously or through a programmed intermittent schedule to satisfy the whole-house ventilation rate.”

**FIRST** implication that makeup needed - “exchange indoor air for outdoor...”

# NYS Residential Code Ventilation Requirements...

CAN be exhaust-only, supply-only, or balanced

## Exhaust Only

- Can use a bath or other fan as part of the system
- Must have an accessible override to go to full on (during times of high moisture) or off
- Can be run intermittently per Residential code criteria
- Automatic Control
  - Timer, Programmable, Humidistat

## Supply Only

- Ditto above except supply to some general area of house (not bath)
- Usually supplied to basement near HVAC/DHW appliances

# NYS Residential Code Ventilation Requirements...

**Sec. R303.4 and R1505.4 Mechanical ventilation.**

**Where the air infiltration rate of a dwelling unit is 5 air changes per hour or less... (testing required by ECCCNY to 3 ACH50) the dwelling unit shall be provided with *whole-house mechanical ventilation in accordance with Section M1505.4***

# NYS Residential Code Ventilation Requirements...

## Balanced

- Can use a bath or other fan as part of the system
- Must have an accessible override to go to full on (during times of high moisture) or off
- Can be run intermittently per Residential code criteria
- Automatic Control
  - Timer, Programmable, Humidistat
- MAKEUP Air of the same flow as the exhaust, controlled automatically with the exhaust

## AND...

- *Can be connected to the return on an air system for distribution*
- *Many E-Star Homes have used passive makeup air systems with barometric dampers*



# NYS Residential Code Ventilation Requirements...

## Technical Bulletin - Handout



### Building Standards and Codes

Division of Building Standards  
and Codes

One Commerce Plaza  
99 Washington Avenue, Suite 1160  
Albany, NY 12231-0001  
(518) 474-4073  
Fax: (518) 486-4487  
[www.dos.ny.gov](http://www.dos.ny.gov)

TB-1003-RCNYS

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## TECHNICAL BULLETIN

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**Code Effective Date:** October 3, 2016

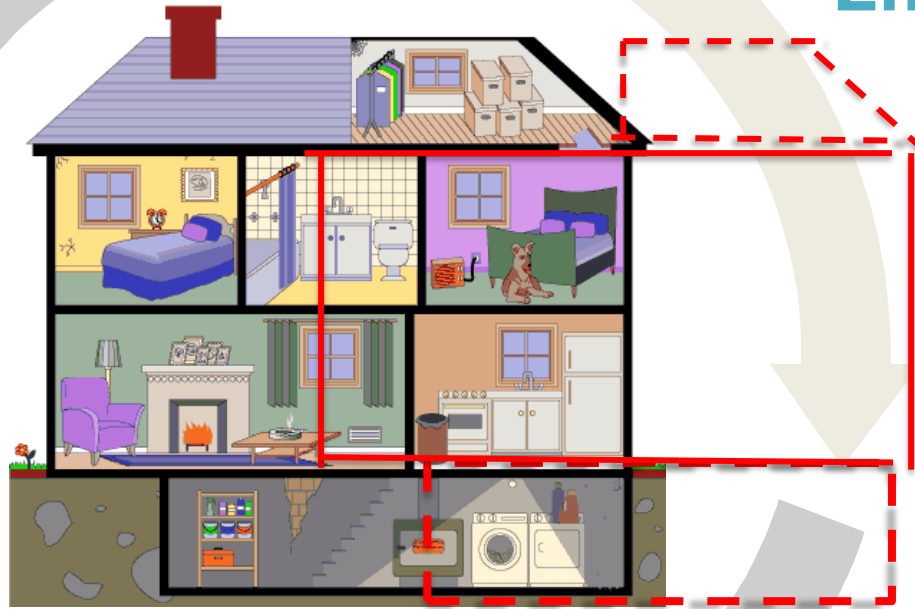
**Source Document:** 19NYCRR 1240 - Energy Code of New York State-2016 (ECNYS)  
19NYCRR 1220 - Residential Code of New York State-2016 (RCNYS)

**Topic** Section(s) R403.6 (ECNYS), (1103.6-RCNYS)-Mechanical Ventilation  
(Mandatory)  
Section M1507 - Whole House Mechanical Ventilation (RCNYS)

# Why Ventilate – House as a System

Envelope

Environment



Mechanical

Occupants

# Home Building Changes

## Envelope

- Bigger houses
- Smaller lots
- More and larger windows
- Tighter envelopes
- More insulation
- More complex roofs

## Mechanicals

- High Efficiency HVAC
- More air-conditioning
- More plumbing
- More exhaust fans
- More fuel choices
- More appliances and lighting



## Multifamily ventilation tends to be more complex

- IAQ Issues - Air Infiltration:
  - Neighboring Units
  - Garage
  - Hallway/Common - Odors
- IAQ Issues - Off Gassing:
  - Cabinets
  - Carpets
  - CO/Combustion
  - Furniture
- IAQ Issues - Moisture & Mold:
  - Leaks
  - Humidity

## Multifamily



# Multifamily Ventilation

## Multifamily ventilation is more important than ever

- Both Low rise and High rise:
  - Property owners are retaining ownership longer than ever.
  - Less desirable land available
  - Gut and rehab, very active
- IAQ Issues & Concerns:
  - Building health concerns
  - Isolating units from Common Building
  - Extensive Air Sealing during rehab
  - Meeting Fire and ventilation codes
- IAQ Issues - Water:
  - Managing moisture, Mold & Mildew
  - Building longevity



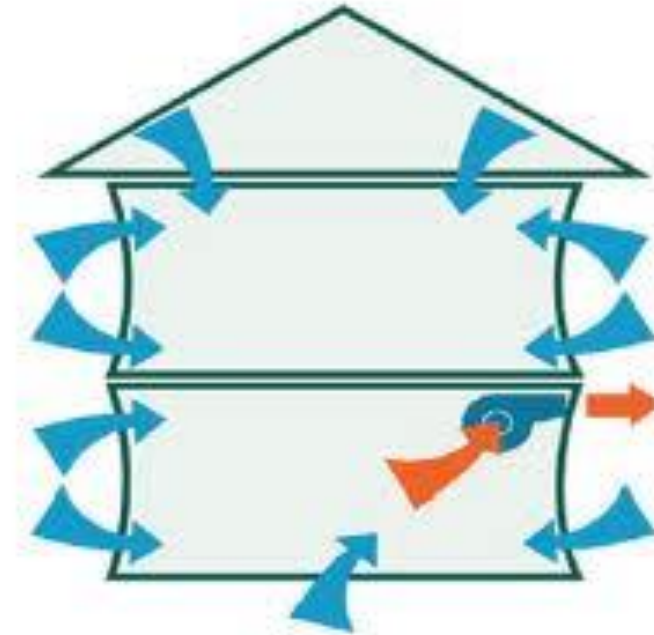
# ASHRAE 62.2 – Whole Building EXHAUST

## Typical Solution

- Continuous bathroom exhaust fans run at low speed or higher speed exhaust fan with intermittent control

## Advantages

- Typically the most ‘cost-effective’ solution
- Can be designed to handle local bathroom exhaust and whole house needs with the same equipment
- Can provide drying potential in cold climates



## Effect on the House

- Negative indoor pressure draws exterior air into space by infiltration

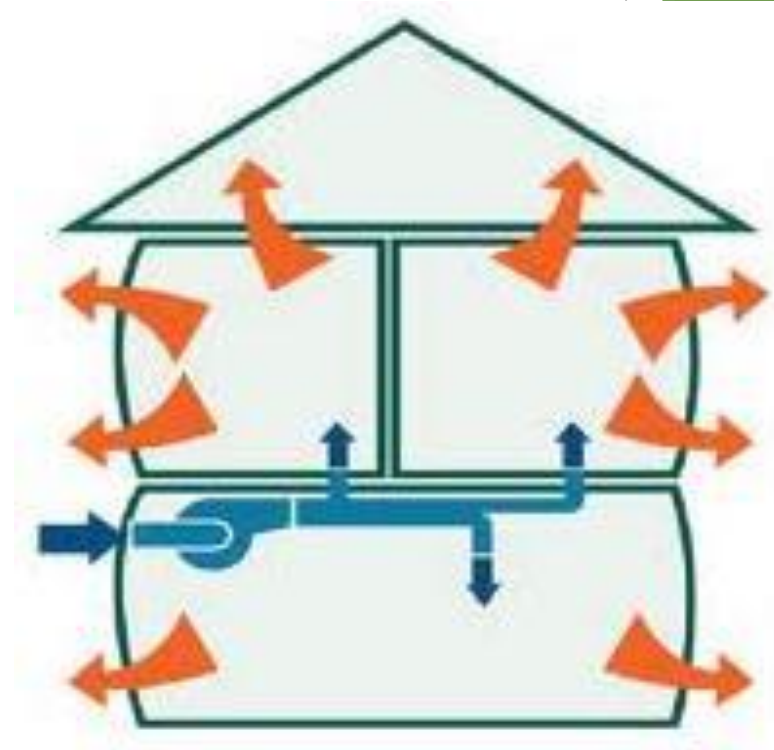
# ASHRAE 62.2 - Whole Building SUPPLY

## Typical Solution

- Powered Supply Fan with Motorized damper, with intermittent open/close cycle attached to HVAC Return

## Advantages

- Simple- but can be involved install
- Fresh air comes from a known location; can be filtered, heated, cooled, dehumidified
- Can reduce introduction of moisture into wall cavities in hot, humid climates
- Decreases chances for combustion appliance spillage



## Effect on the House

- Positive indoor pressure pushes interior air outside by exfiltration

# ASHRAE 62.2 - Whole Building BALANCED

## Typical Solution

- HRV/ERV stand-alone unit, or attached to HVAC.

### Advantages

- House stays in balance
- Opportunity for heat and moisture (energy) recovery may make up for increased cost of HRV/ERV
- Remote mounted unit is quieter
- Fresh air comes from a known location; can be filtered, heated, cooled, dehumidified
- Ideal solution for high IAQ/IEQ environments, but be conscious of costs to operate AHU fan to distribute air.



## Effect on the House

- Balanced airflow between interior and exterior
- Homeowner education required to ensure they understand, operate and maintain the system



# Advanced, Green & Beyond Code Programs



# ENERGY STAR® Homes

**A voluntary government backed  
program that helps individuals and  
businesses protect the environment  
through energy efficiency**



# A Joint Program



ENERGY STAR<sup>®</sup>

Is a joint program of the



U.S. Environmental Protection Agency

and the

U.S. Department of Energy

*helping us all save money and protect the environment  
through energy efficient products and practices*

# ENERGY STAR® Labeled Homes - TOWARD NET ZERO!

## ENERGY STAR® Labeled Homes

Increased Features & Benefits

Homebuyer

Builder

Environment

Program Incentives

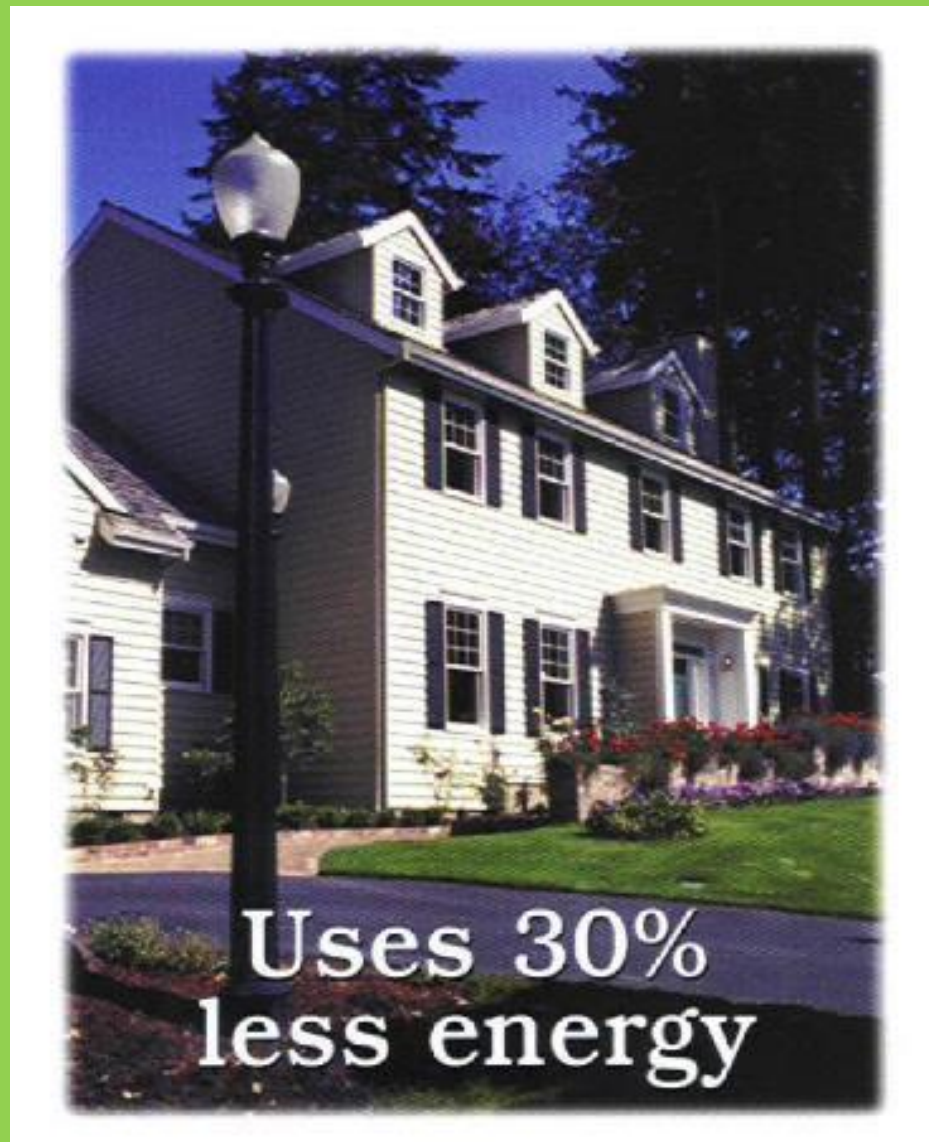
Builder

Co-Op Advertising

Program Participation

Building

Marketing





## **ENERGY EFFICIENCY**

**Energy efficiency is the quickest, cleanest and cheapest way to extend our nation's energy supplies**

# Energy Conservation

## Orientation

- Southern exposure

  - Helps heat your home in the winter

  - Protects against heat gain in the summer

- Paying attention to the details

  - Keeps the home from overheating in the summer

## Windows

- Large window areas

  - Increase construction costs

  - Drive up energy costs

- Energy Efficient Windows

  - Low-e coatings

  - Insulating spacers

  - Low-conductivity framing materials

# Energy Conservation

## Air infiltration

Seal the thermal envelope

Junctures

Penetrations

Gaps or holes

Electrical outlets

Through-wall pipes

Around windows

At wall corners

At bottom and top plates

## Insulation

Climate-based recommendations from DOE

Installed per Manufacturers recommendations

# Energy Conservation

## Mechanical systems

- High efficiency equipment
- Properly sized using industry standard manuals
- Centrally located HVAC equipment

## Improved duct layout design

- Run in conditioned spaces
- Properly sized
- Sealed with mastic
- Return air runs hard-ducted, not run in wall cavities.



# Energy Conservation

## Water heating equipment

- High efficiency

- Centrally located

- Tankless water heaters

  - Supply more hot water

  - Lower energy costs

## Energy efficient lighting and appliances

- 500 kWh annual savings

# Energy Conservation

## Indoor Air Quality

Mechanical ventilation

Provides fresh air

Dilutes indoor pollutants

VOCs

Cooking odors

Unwanted moisture

Sealing all walls common to the garage helps keep dangerous exhaust gases from entering the home.

# ENERGY STAR® Labeled Homes

## Extra benefits mean more value!

Consumers can expect more value from their home purchase including:

- Lower Energy Bills
- Increased Comfort
- Improved Indoor Air Quality
- More Durable, Quality Construction
- Higher Resale Value
- Easier on the Environment

# Lower energy bills

Approximately 30% more energy efficient than a standard built home

Tested & certified energy efficient home

Savings could fund anything from college tuition to vacations

Savings could help to pay off mortgage early

# Increased Comfort

Walls are warmer in winter & cooler in summer

No cold spots

No drafty windows

More even distribution of heating & cooling

No annoying drafts or airborne dust

More consistent temperature

Tighter, quieter home



# Improved Indoor Air Quality

## Health & Safety

Ventilation provides fresh, clean air.  
Reduced indoor pollutants  
Fewer holes where pollen, dust,  
pollution, and insects can enter your  
home  
Healthier living environment



# More Durable Quality Construction

Greater attention paid to construction details

High-efficiency equipment is quieter and lasts longer

Fewer moisture problems resulting in longer-lasting building materials

Fewer call-backs



# HIGHER RESALE VALUE



- ▶ More durable materials
- ▶ Reduction of moist air
- ▶ Attention to construction quality
- ▶ Fewer problems and fewer call-backs
- ▶ Higher resale price than average homes





# Increased Home Value

A study by The Appraisal Journal found that the selling price of homes increased by \$20.73 for every \$1 decrease in energy bills.

If your energy bills average \$1,500/yr. and you saved \$400/yr., your home value would increase by \$8,300.

# Environmental Benefits

Preserve precious natural resources

Reduce Air Pollution

By 2012, the U.S. EPA estimates ENERGY STAR®-built homes will reduce pollution by the equivalent of 3,000,000 cars

# Builder Benefits

## Higher Home Value

- Lower Energy Costs
- Increased Comfort
- Improved Air Quality

## Less Callbacks

- Greater Durability

## Environmental Responsibility

- Healthier Living Environment
- Reduced air pollution

## Cash Incentives



# Energy Conservation

## Other Considerations

- Water-saving products

  - Low-flow showerheads

  - Low-flow faucets

  - Low-flow toilets

  - Water wise landscaping practices

- Roofing, siding, decking products that have a long service life require less maintenance over time

# LEED FOR HOMES UPDATE



# The Home Building Industry's View

- ▶ Green home building is at a tipping point among the builder population
- ▶ As of 2006, 50% of builders “are focusing their attention on green building issues”
- ▶ It's the right thing to do





Public Perception?

Reality





# Applicable Building Types

Single Family



Market Rate &  
Affordable

Multi-Family



Up to 3  
Stories

Gut Rehab



Strip to Studs  
on One Side

# Checklist

Simple

- ❖ 1 page (both sides)
- ❖ 100 points
- ❖ Entry level = 30 pts.

LEED for HOMES		Project Checklist		Maximum Points <sup>2</sup>	
		Builder Name:	Address (Street/City/State):		Dry Normal Wet
Yes ? No	Location and Linkages	OR			
<b>HOLD</b>	<b>1 LEED-ND Neighborhood</b>	<b>LL2-5 10</b>			
	<b>2 Site Selection</b>	Avoid Environmentally Sensitive Sites and Farmland	<b>LL1</b>	<b>2</b>	
	<b>3.1 Infrastructure</b>	Site within 1/2 Mile of Existing Water, Sewer, and Roads	<b>LL1</b>	<b>1</b>	
	<b>3.2</b>	Select an Infill Site	<b>LL1</b>	<b>1</b>	
	<b>4.1 Community Resources</b>	Within 1/4 mile of Basic Community Resources / Public Transportation	<b>LL1</b>	<b>1</b>	
	<b>4.2</b>	Within 1/4 Mile of Extensive Community Resources / Public Transportation	<b>LL1</b>	<b>2</b>	
	<b>4.3</b>	<b>AND/OR</b> Within 1/2 Mile of Green Spaces	<b>LL1</b>	<b>1</b>	
	<b>5.1 Compact Development</b>	Average Housing Density $\geq 7$ Units / Acre	<b>LL1</b>	<b>1</b>	
	<b>5.2</b>	Average Housing Density $\geq 10$ Units / Acre	<b>LL1</b>	<b>2</b>	
	<b>5.3</b>	<b>OR</b> Average Housing Density $\geq 20$ Units / Acre	<b>LL1</b>	<b>3</b>	
	<b>Sub-Total</b>				
Yes ? No	Sustainable Sites	OR			
	<b>1.1 Site Stewardship</b>	Minimize Disturbed Area of Site (If Site > 1/3 Acre)	Required		
	<b>1.2</b>	Erosion Controls (During Construction)	Required		
	<b>2.1 Landscaping</b>	Basic Landscaping Design	Required		
	<b>2.2</b>	Apply 3 to 4 Inches of Mulch Around Plants		<b>1</b>	
	<b>2.3</b>	Limit Turf		<b>5</b>	<b>3 1</b>
	<b>2.4</b>	Minimize Landscape Water Demand		<b>3</b>	<b>2 1</b>
	<b>3 Shading of Hardscapes</b>	Locate and Plant Trees to Shade Hardscapes		<b>1</b>	
	<b>4.1 Surface Water Management</b>	Install Permeable Material for at Least 65% of Lot (If Lot $\geq 1/4$ acre)	Required		
	<b>4.2</b>	Use Permeable Paving Materials		<b>1</b>	<b>3 5</b>
	<b>4.3</b>	Design and Install Permanent Erosion Controls		<b>1</b>	<b>2 3</b>
	<b>Non-Toxic Pest Control</b>	Select Insect and Pest Control Alternatives from List		<b>2</b>	
	<b>Sub-Total</b>				
Yes ? No	Water Efficiency	OR			
	<b>1.1 Water Reuse</b>	Rainwater Harvesting System		<b>1</b>	
	<b>1.2</b>	Grey Water Re-Use System		<b>1</b>	
	<b>2.1 Irrigation System</b>	Main Shutoff Valve, Sub-Meter, and Third-Party Inspection	Required		
	<b>2.2</b>	Select High Efficiency Measures from List		<b>5</b>	<b>3 1</b>
	<b>2.3</b>	Rain Sensing Controls		<b>1</b>	
	<b>3.1 Indoor Water Use</b>	High Efficiency Fixtures (Toilets, Showers, and Faucets)		<b>3</b>	
	<b>3.2</b>	<b>OR</b> Very High Efficiency Fixtures (Toilets, Showers, and Faucets)		<b>6</b>	
	<b>Sub-Total</b>				
Yes ? No	Indoor Environmental Quality	OR			
	<b>1 ENERGY STAR with IAP</b>	Meets ENERGY STAR w/ Indoor Air Package (IAP)	<b>IE2-10</b>	<b>10</b>	
	<b>2.1 Combustion Venting</b>	Space Heating and DHW Equip w/ Closed/Power-Exhaust, & CO Monitor	<b>IE1</b>	Required	
	<b>2.2</b>	Fireplaces w/ Outside Air Supply and Closed Combustion	<b>IE1</b>	Required	
	<b>3 Humidity Control</b>	Analyze Moisture Loads AND Install Central System (where Needed)	<b>IE1</b>	<b>1</b>	
	<b>4.1 Outdoor Air Ventilation</b>	Meets ASHRAE Std 62.2	<b>IE1</b>	Required	
	<b>4.2</b>	Dedicated Outdoor Air System (w/ Heat Recovery)	<b>IE1</b>	<b>2</b>	
	<b>4.3</b>	Third-Party Testing of Outdoor Air Flow Rate into Home		<b>1</b>	
	<b>5.1 Local Exhaust</b>	Meets ASHRAE Std 62.2	<b>IE1</b>	Required	
	<b>5.2</b>	Timer / Automatic Controls for Bathroom Exhaust Fans	<b>IE1</b>	<b>1</b>	
	<b>5.3</b>	Third-Party Testing of Exhaust Air Flow Rate Out of Home		<b>1</b>	
	<b>6.1 Supply Air Distribution</b>	Meets ACCA Manual D	<b>IE1</b>	Required	
	<b>6.2</b>	Third-Party Testing of Supply Air Flow into Each Room in Home		<b>2</b>	
	<b>7.1 Supply Air Filtering</b>	$\geq 8$ MERV Filters, w/ Adequate System Air Flow	<b>IE1</b>	Required	
	<b>7.2</b>	$\geq 10$ MERV Filters, w/ Adequate System Air Flow		<b>1</b>	
	<b>7.3</b>	<b>OR</b> $\geq 12$ MERV Filters, w/ Adequate System Air Flow		<b>2</b>	
	<b>8.1 Contaminant Control</b>	Seal-Off Ducts During Construction	<b>IE1</b>	Required	
	<b>8.2</b>	Permanent Walk-Off Mats <b>OR</b> Central Vacuum		<b>1</b>	
	<b>8.3</b>	Third-Party Testing of Particulates and VOCs before Occupancy		<b>1</b>	
	<b>9.1 Radon Protection</b>	Install Radon Mitigation System if Home is Located in EPA Region 1	<b>IE1</b>	Required	
	<b>9.2</b>	Install Ground Contaminant Mitigation System (Outside of EPA Region 1)	<b>IE1</b>	<b>1</b>	
	<b>10.1 Vehicle Emissions Protection</b>	No Air Handling Equipment <b>OR</b> Return Ducts in Garage	<b>IE1</b>	Required	
	<b>10.2</b>	Tightly Seal Shared Surfaces between Garage and Home	<b>IE1</b>	Required	
	<b>10.3</b>	Exhaust Fan in Garage <b>OR</b> No Garage in Contact with Home	<b>IE1</b>	<b>1</b>	
	<b>Sub-Total</b>				

Yes ? No	Materials and Resources	OR			
	<b>1 Home Size</b>	Home that is Smaller than National Average		<b>10</b>	
	<b>2.1 Material Efficient Framing</b>	No Extra Uses of Lumber for Aesthetic Purposes	Required		
	<b>2.2</b>	Advanced Framing Techniques		<b>2</b>	
	<b>3 Local Sources</b>	Materials Extracted / Manufactured / Produced within 500 Miles		<b>3</b>	
	<b>4.1 Durability Plan</b>	Detailed Durability Plan: (Pre-Construction)	Required		
	<b>4.2</b>	Third-Party Verification of Implementation of Durability Plan		<b>1 3 5</b>	
	<b>5.1 Environmentally Preferable Products</b>	Tropical Hardwoods, if used, must be FSC	Required		
	<b>5.2</b>	Select Environmentally Preferable Products from List		<b>4</b>	
	<b>6.1 Waste Management</b>	Max of 2.5 Lbs Per Square Foot of Construction Waste Sent to Landfill	Required		
	<b>6.2</b>	0.5 Pts for Each Additional 0.5 Lbs Per Square Foot Reduction		<b>2</b>	
	<b>Sub-Total</b>				
Yes ? No	Energy and Atmosphere	OR			
	<b>1.1 ENERGY STAR Home</b>	Meets ENERGY STAR for Homes with Third-Party Testing	Required		
	<b>1.2</b>	Exceeds ENERGY STAR for Homes, 2 Pts Per HERS Point > HERS 86	<b>EA2-7</b>	<b>16</b>	
	<b>2.1 Insulation</b>	Third-Party Inspection of Insulation Installation, At Least HERS Grade II	<b>EA1</b>	Required	
	<b>2.2</b>	Third-Party Inspection of Insulation Installation, At Least HERS Grade I	<b>EA1</b>	<b>1</b>	
	<b>2.3</b>	<b>OR</b> Above Code Insulation; At Least 5% > Local Code Per REScheck	<b>EA1</b>	<b>1</b>	
	<b>3.1 Air Infiltration</b>	Third-Party Envelope Air Leakage Tested $\leq 0.35$ ACH	<b>EA1</b>	Required	
	<b>3.2</b>	Third-Party Envelope Air Leakage Tested $\leq 0.25$ ACH	<b>EA1</b>	<b>1</b>	
	<b>3.3</b>	<b>OR</b> Third-Party Envelope Air Leakage Tested $\leq 0.15$ ACH	<b>EA1</b>	<b>2</b>	
	<b>4.1 Windows</b>	Windows Meet ENERGY STAR for Windows (See Table)	<b>EA1</b>	Required	
	<b>4.2</b>	Windows Exceed ENERGY STAR for Windows by $\geq 10\%$ (See Table)	<b>EA1</b>	<b>1</b>	
	<b>4.3</b>	<b>OR</b> Windows Exceed ENERGY STAR for Windows by $\geq 20\%$ (See Table)	<b>EA1</b>	<b>2</b>	
	<b>5.1 Duct Tightness</b>	Third-Party Duct Leakage Tested $\leq 5.0$ CFM25 / 100 SF to Outside	<b>EA1</b>	Required	
	<b>5.2</b>	Third-Party Duct Leakage Tested $\leq 3.0$ CFM25 / 100 SF to Outside	<b>EA1</b>	<b>1</b>	
	<b>5.3</b>	<b>OR</b> Third-Party Duct Leakage Tested $\leq 1.0$ CFM25 / 100 SF to Outside	<b>EA1</b>	<b>2</b>	
	<b>6.1 Space Heating and Cooling</b>	Meets ENERGY STAR for HVAC w/ Manual J & refrigerant charge test	<b>EA1</b>	Required	
	<b>6.2</b>	Exceeds ENERGY STAR for HVAC by $\geq 10\%$ , w/ Manual J	<b>EA1</b>	<b>1</b>	
	<b>6.3</b>	<b>OR</b> Exceeds ENERGY STAR for HVAC by $\geq 20\%$ , w/ Manual J	<b>EA1</b>	<b>3</b>	
	<b>7.1 Water Heating</b>	Improved Hot Water Distribution System		<b>3</b>	
	<b>7.2</b>	Improved Water Heating Equipment	<b>EA1</b>	<b>3</b>	
	<b>8.1 Lighting</b>	Energy Efficient Fixtures and Controls		<b>1</b>	
	<b>8.2</b>	<b>OR</b> ENERGY STAR Advanced Lighting Package		<b>3</b>	
	<b>9.1 Appliances</b>	Select Appliances from List		<b>2</b>	
	<b>9.2</b>	Very Efficient Clothes Washer (MEF > 1.8, AND WF < 5.5)		<b>1</b>	
	<b>10 Renewable Energy</b>	Renewable Electric Generation System (1 Point / 10% Annual Load Reduction)		<b>6</b>	
	<b>11 Refrigerant Management</b>	Minimize Ozone Depletion and Global Warming Contributions		<b>1</b>	
	<b>Sub-Total</b>				
Yes ? No	Homeowner Awareness	OR			
	<b>1.1 Homeowner Education</b>	Basic Owner's Manual and Walkthrough of LEED Home	Required		
	<b>1.2</b>	Comprehensive Owner's Manual and Multiple Walkthroughs / Trainings		<b>1</b>	
	<b>Sub-Total</b>				
Yes ? No	Innovation and Design Process	OR			
	<b>1.1 Innovative Design</b>	Provide Description and Justification for Specific Measure		<b>1</b>	
	<b>1.2</b>	Provide Description and Justification for Specific Measure		<b>1</b>	
	<b>1.3</b>	Provide Description and Justification for Specific Measure		<b>1</b>	
	<b>1.4</b>	Provide Description and Justification for Specific Measure		<b>1</b>	
	<b>Sub-Total</b>				
	<b>Project Totals <sup>1</sup> (pre-certification estimates)</b>	<b>108</b>			
<b>Notes:</b> 1. Certified 30-49 points Silver 50-69 points Gold 70-89 points Platinum 90-108 points 2. *Points* are shown for 3 precipitation zones: Dry (< 20 inches / year); Normal (20-40 inches / year); and Wet (> 40 inches / year)					
I hereby attest that I have verified all of the indicated credits above as installed in the home identified above.					
Rater's Name		Company			
Signature		Date			
I hereby attest that I have reviewed the verification information, and certify that this home meets the requirements of LEED for Homes					
Provider's Name		Company			
Signature		Date			

# Rating System

Rating System  
For Pilot Demonstration of  
LEED® for Homes Program

US Green Building Council

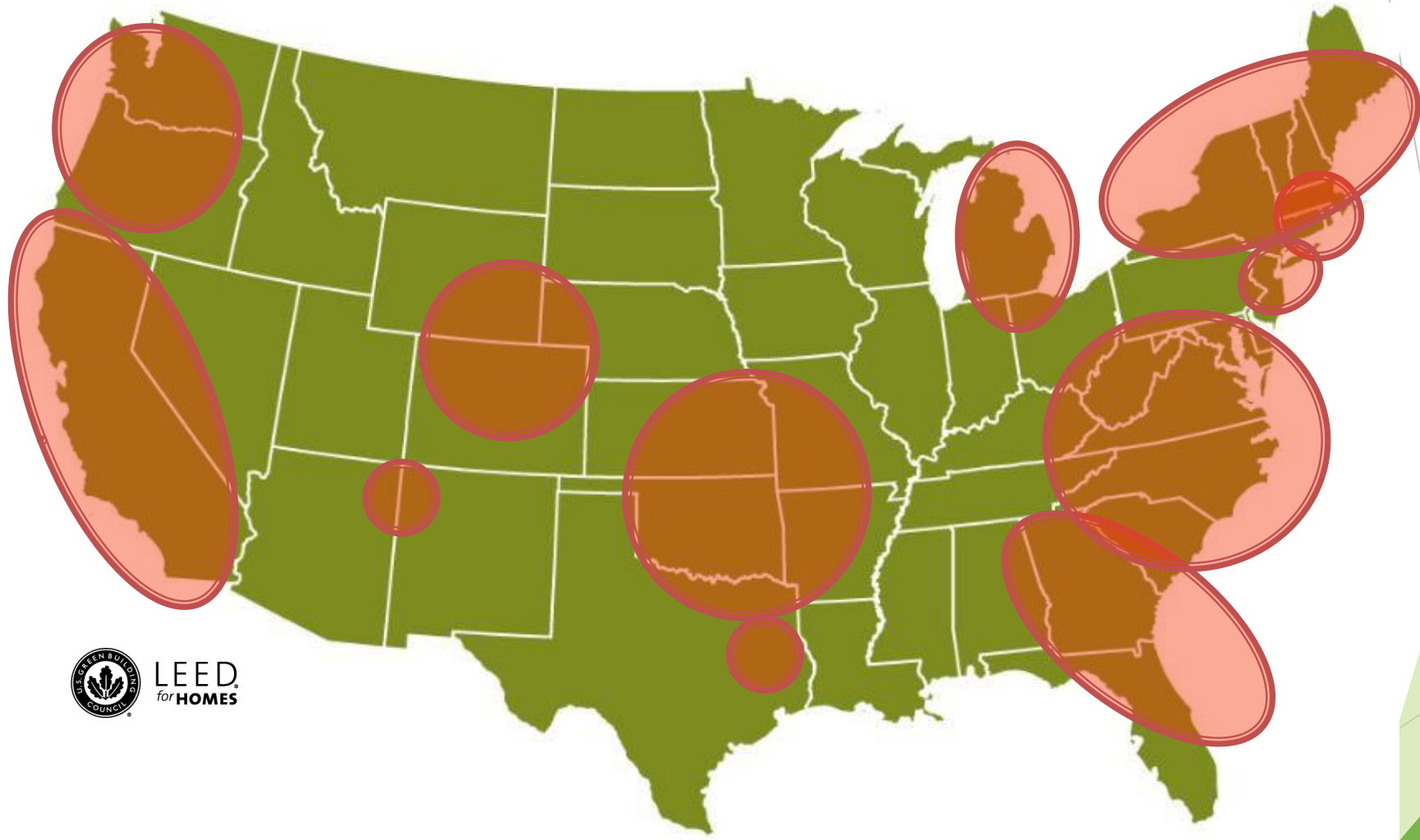
August 5, 2005

[www.usgbc.org/leed/homes](http://www.usgbc.org/leed/homes)



LEED®  
*for* **HOMES**

# Pilot Markets



# Who is Working with LEED for Homes?

## National Programs



ENVIRONMENTS FOR **Living**

## Local and Regional Programs



# What is the Media saying about LEED for Homes?

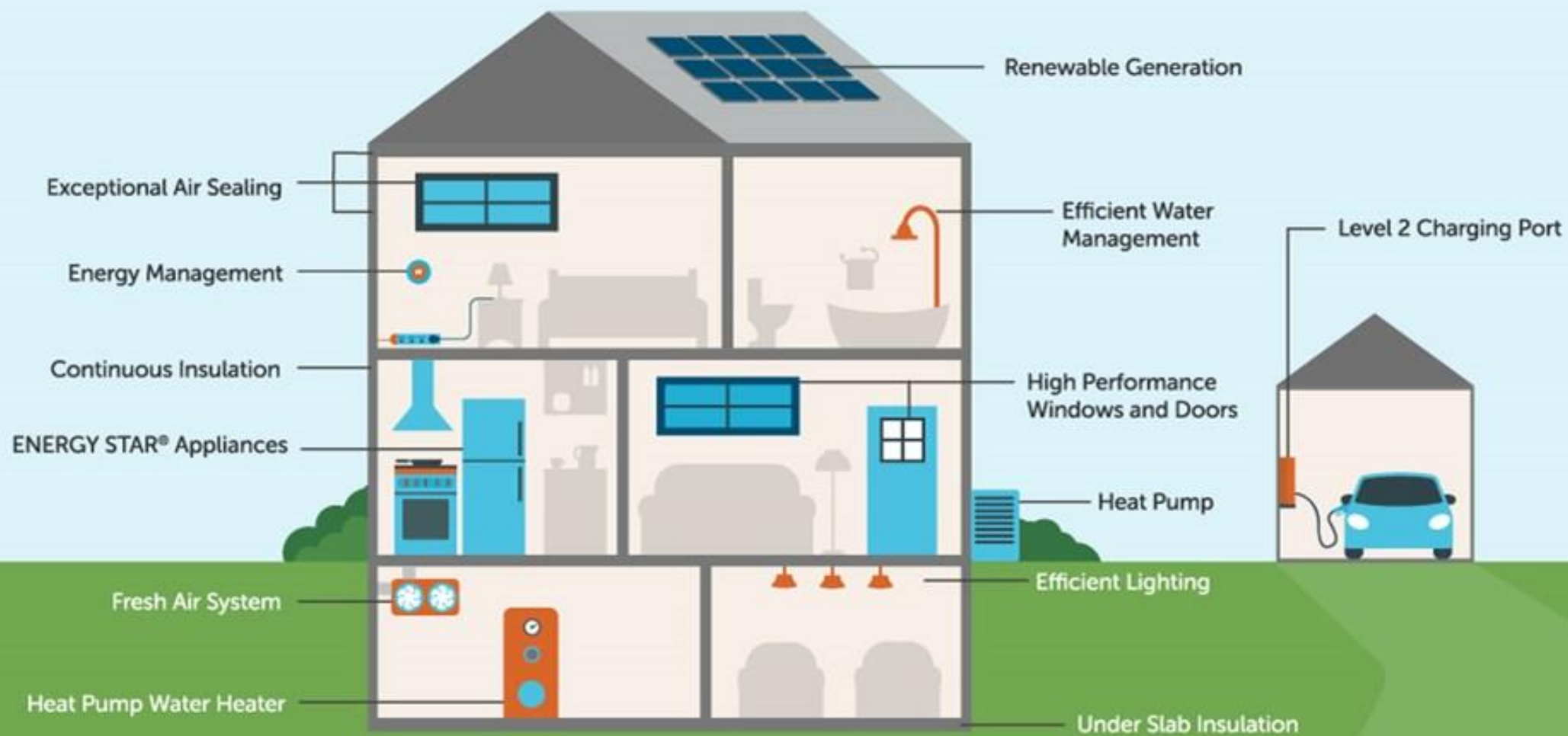


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# Net Zero Energy (NZE)



# Net Zero Energy (NZE)





# Passiv House



# Passiv House

## Introduction to Passive House

- Passivhaus is a rigorous German building standard that combines very high levels of superinsulation with passive solar gain and fresh air distribution to achieve extremely low energy loads as well as a healthy, comfortable, and durable building
- Approach focuses on minimizing losses and maximizing usable gains, for an optimal energy balance

# Passiv House

Four criteria:

- Annual heating load  $<15 \text{ kWh/m}^2/\text{yr}$  ( $4.75 \text{ kBTU/ft}^2/\text{yr}$ )
- Annual cooling load  $<15 \text{ kWh/m}^2/\text{yr}$  ( $4.75 \text{ kBTU/ft}^2/\text{yr}$ )
- Annual primary energy load  $<120 \text{ kWh/m}^2/\text{yr}$   
( $38 \text{ kBTU/ft}^2/\text{yr}$ )
- Blower door tested to  $<0.6 \text{ ACH}_{50}$

This is a small fraction of the heating load of a typical house (no more than 20%) and under half of the primary energy consumption (lots of “it depends on...” here).

# Passiv House

## Basic Features of PHs

- Compact form and superinsulation; thermal bridges accounted for
- Solar and internal gains are significant offsets to load
- Fresh air ventilation via heat recovery
- Efficient DHW use plus SDHW or HPWH
- Efficient Appliances

# Passiv House

## Challenges in the US

- One size fits all criteria regardless of climate
- Availability of windows, glazing, HRVs comparable to German products
- Cooling is much more prevalent here
- Based on floor area so favors larger buildings
- Difficult in New England climate to deliver heating in ventilation air
- Higher solar availability in the US shifts the optimum balance between investment in load reduction and renewable generation

# What the Focus Is On



# Code Intent...

## Energy - Chapter 103

## Residential- Chapter 104

In NY - Energy and Residential Codes

“Alternate Materials...”

“The Provisions of this code are not intended to prevent the use of any materials, method of construction...

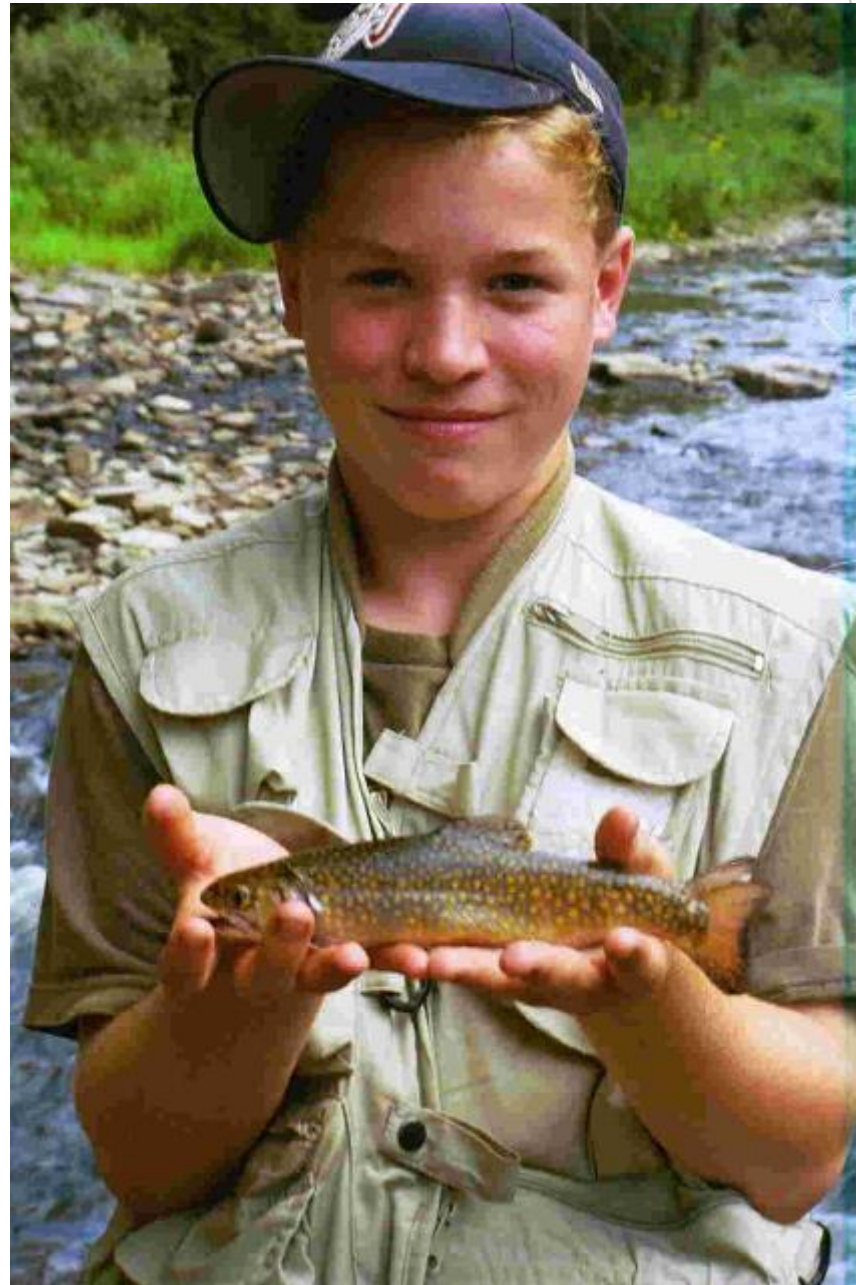
Approved by the State Fire Prevention and Building Code Council as meeting the intent of this code.”

Promote product testing/verification!

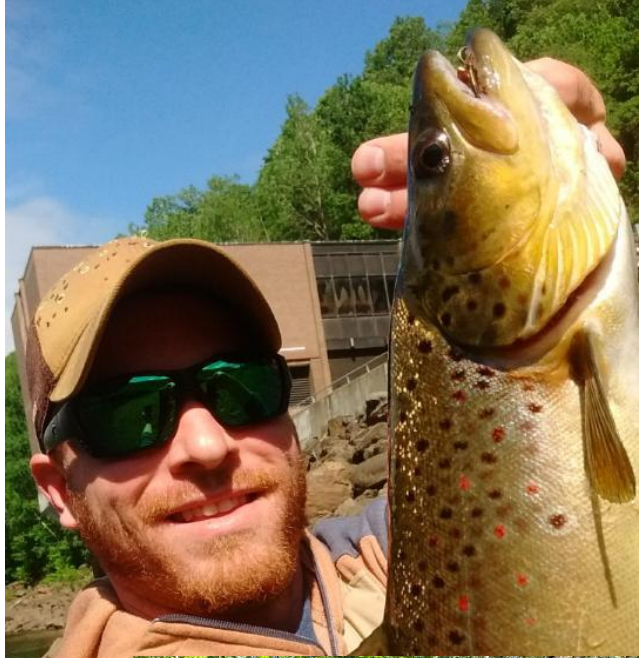
Go for ES evaluation!

Work with CEO's NY-DOS and Code Council on approval!

**Why I do this  
stuff!**







*Thank You!*



**Mike DeWein**  
**North Branch Services**

- Energy Code Consulting & Municipal Services
- Plan Review Services
- Air Barrier Inspections
- Large Building Blower Door Testing

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