



## **Dow Building Solutions**

2009 IECC:  
The Requirements and  
How They Impact Home Ratings

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2/23/2010

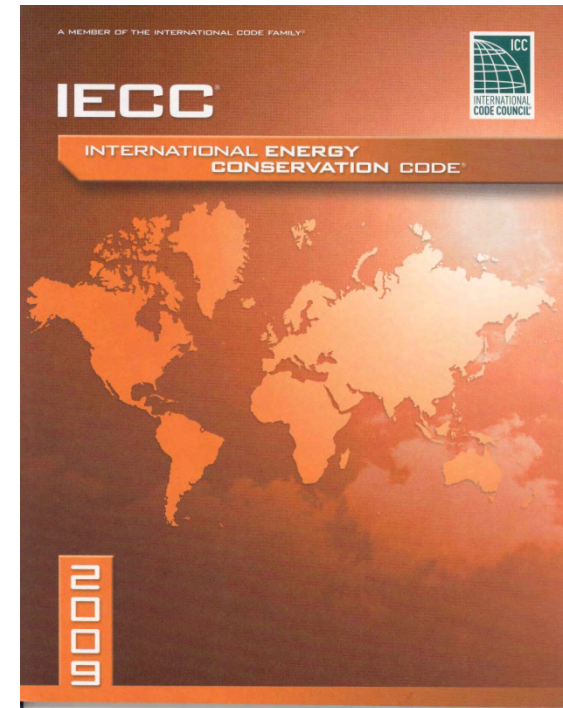
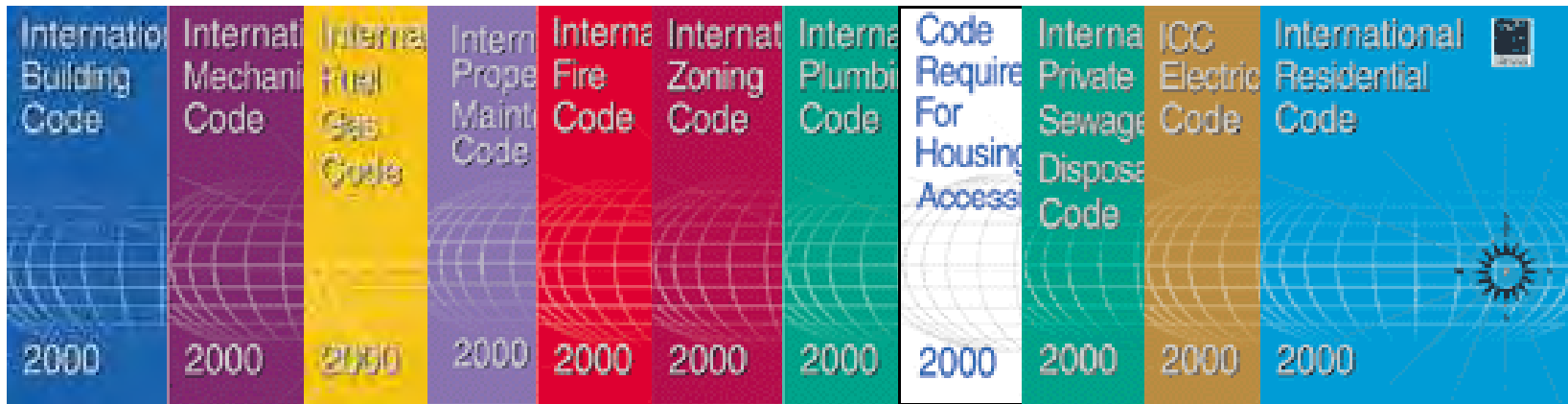
## □ **2009 IECC Requirements**

- Overview
- Scope
- Climate specific requirements
- Non climate specific requirements

## □ **Home Energy Ratings IECC 2009 vs. 2006**

- Scenario 1 – with 0.35 NACH, default duct leakage
- Scenario 2 – with 2009 IECC ACH and duct leakage
- Findings

# The Family of I-Codes





# Relationship Between IRC and IECC

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- ❑ IECC addresses only energy
- ❑ IRC addresses all codes (structural, plumbing, etc.)
  - Allows builder to carry only one code book
  - Chapter 11 has energy
- ❑ IECC addresses both residential and commercial; IRC addresses detached one- and two-family dwellings and townhouses
- ❑ IRC allows compliance with IECC as an alternative to Chapter 11
- ❑ Energy requirements in IRC and IECC almost identical with some differences
  - IRC requires 0.35 SHGC in Climate Zones 1-3; IECC requires 0.30



## Residential Buildings:

- ❑ IRC only for single-family, duplex, and townhouses
- ❑ IECC has all low-rise (1-3 stories) houses, condos, and apartments [R-2, R-3, R-4], but not hotels/motels [R-1]
- ❑ All buildings that are not “residential” by definition are “commercial”

Includes repairs, alterations, and additions

e.g., window replacements



# What's Changed Since IECC 2006?

- ❑ Stringency – some key differences
- ❑ New requirements
  - Building envelope tightness
  - Duct testing
  - Lighting equipment
  - Pool controls and covers
  - Snow melt controls
- ❑ Moisture control requirements moved to IRC
- ❑ No mechanical trade-offs allowed

# Structure of the IECC

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❑ Chapter 1 Administrative

❑ Chapter 2 Definitions

❑ Chapter 3 Climate Zones

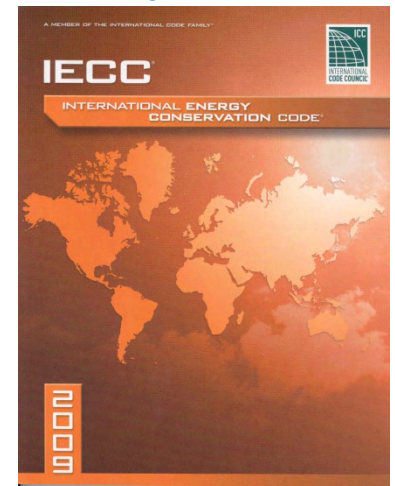
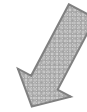
❑ Chapter 4 Residential Energy Efficiency

❑ Chapter 5 Commercial Energy Efficiency

❑ Chapter 6 Referenced Standards

➤ Residential

➤ Chapter



## Overview of Residential Requirements

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- ❑ Focus is on building envelope
  - Ceilings, walls, windows, floors, foundations
  - Sets insulation levels, window U-factors and solar heat gain coefficients
  - Infiltration control - caulk and seal to prevent air leaks
- ❑ Ducts – seal and insulate
- ❑ Limited space heating, air conditioning, and water heating requirements
  - Federal law sets most equipment efficiency requirements, not the I-codes
- ❑ No appliance requirements
- ❑ Lighting equipment – 50% of lamps to be high-efficacy lamps

## Exceptions to Meeting Thermal Building Envelope Provisions

- ❑ Very low energy use buildings (peak design demand  $<3.4$  Btu/h-ft<sup>2</sup> or 1 watt/ft<sup>2</sup>)
- ❑ Buildings (or portions of) that are neither heated nor cooled
- ❑ Existing buildings (Section 101.4.1)
  - Electrical power, lighting, and mechanical systems still apply
- ❑ Buildings designated as historic (Section 101.4.2)



# Additions, Alterations, Renovations, Repairs

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- ❑ Conform as relates to new construction
- ❑ Unaltered portion(s) do not need to comply
- ❑ Additions can comply alone or in combination with existing building

- ❑ **Exceptions**

- Storm windows over existing fenestration
- Glass only replacements
- Exposed, existing ceiling, wall or floor cavity if already filled with insulation
- Where existing roof, wall or floor cavity isn't exposed
- Reroofing for roofs where neither sheathing nor insulation exposed. Roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated either above or below the sheathing.

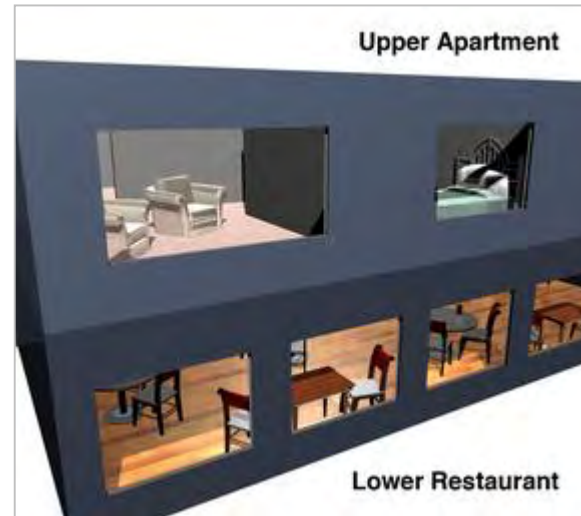


# Mixed Use Buildings

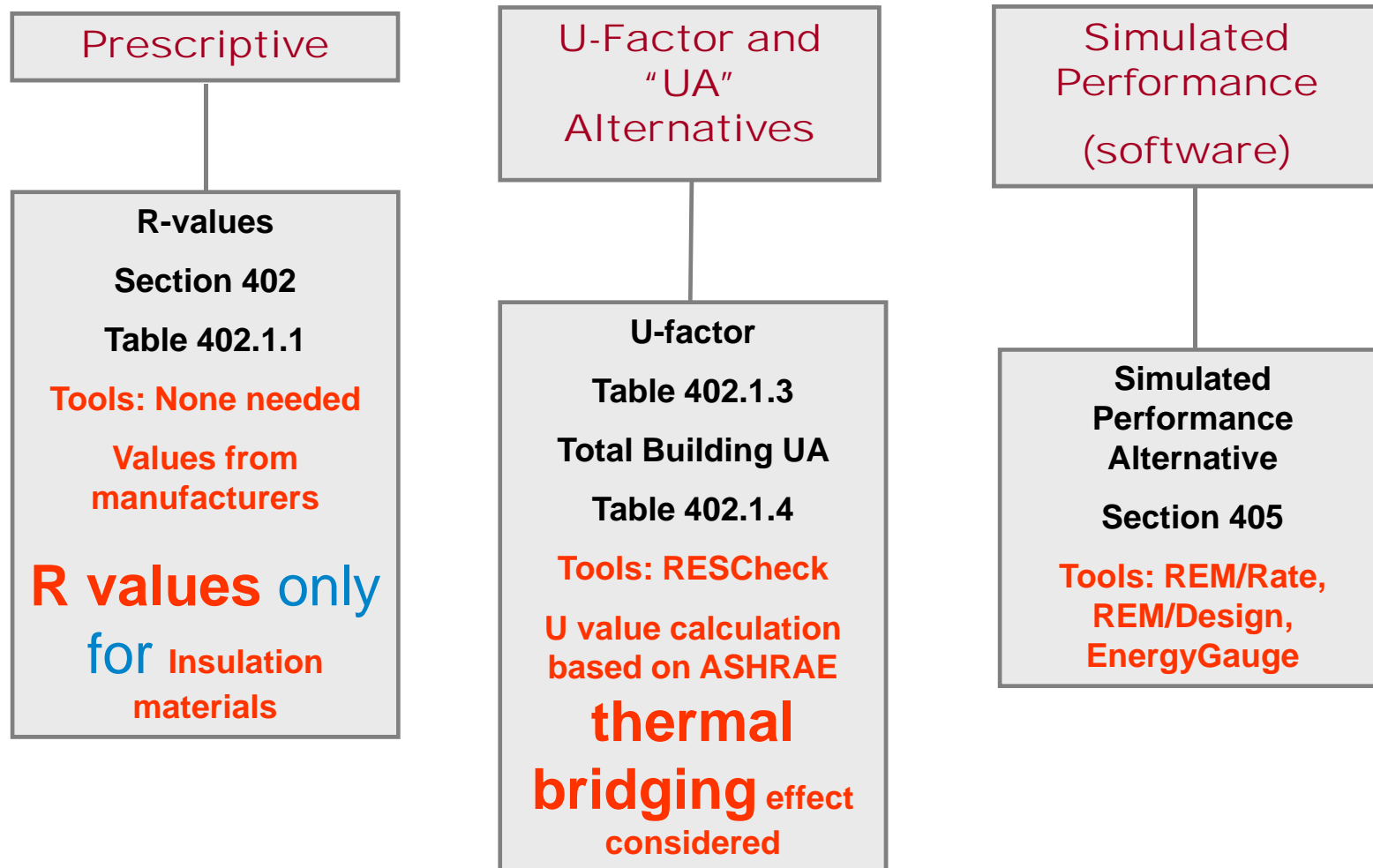
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## □ Mixed occupancies

- Treat the residential occupancy under the applicable residential code
- Treat the commercial occupancy under the commercial code



# IECC Compliance - Three Options



# Climate-Specific Requirements

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## Climate-Specific Requirements:

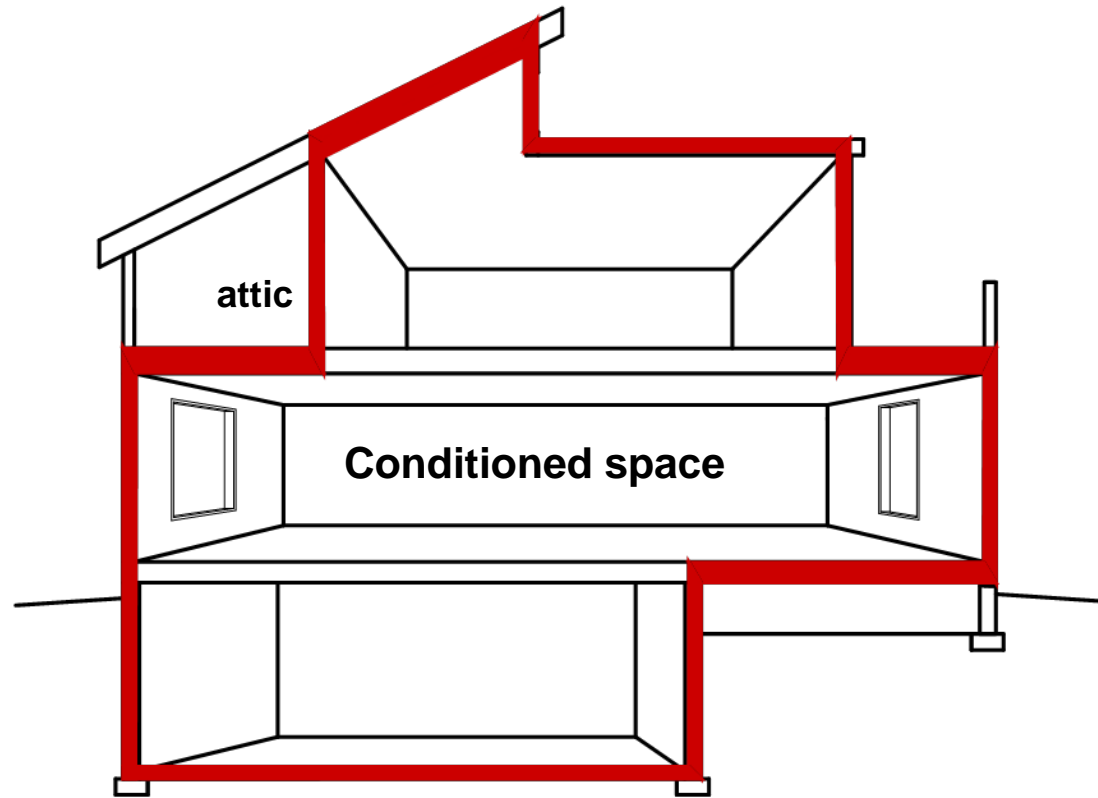
- Foundations
  - ↪ Basements
  - ↪ Slabs
  - ↪ Crawlspace
- Above grade walls
- Skylights, windows, and doors
- Roofs
- Solar Heat Gain Coefficient in warm climates

## Universal Requirements (apply everywhere):

- Duct insulation and sealing
- Infiltration control

# Building Envelope Specific Requirements

- Building Envelope consists of:
  - Fenestration
  - Ceilings
  - Walls
    - Above grade
    - Below grade
    - Mass walls
  - Floors
  - Slab
  - Crawl space



# Insulation and Fenestration Requirements by Climate Zone

**Table 402.1.1**  
**Insulation and Fenestration Requirements by Component<sup>a</sup>**  
(numbers in parenthesis are for 2006 IECC requirements)

Climate Zone	Fenestration U-Factor <sup>b</sup>	Skylight <sup>b</sup> U-Factor	Glazed Fenestration SHGC <sup>b, c</sup>	Ceiling Value	Wood Frame Wall R-Value	Mass Wall R-Value <sup>d</sup>	Floor R-Value	Basement <sup>e</sup> Wall R-Value	Slab <sup>f</sup> R-Value & Depth	Crawl Space <sup>g</sup> Wall R-Value
1	1.2	0.75	0.30 (0.40)	30	13	3/4 (3)	13	0	0	0
2	0.65 <sup>i</sup> (0.75)	0.75	0.30 (0.40)	30	13	4/6 (4)	13	0	0	0
3	0.50 <sup>i</sup> (0.65)	0.65	0.30 (0.40)	30	13	5/8 (5)	19	5/13 <sup>j</sup> (0)	0	5/13
4 except Marine	0.35 (0.40)	0.60	NR	38	13	5/10 (5)	19	10/13	10, 2 ft	10/13
5 & Marine 4	0.35	0.60	NR	38	20 (19) or 13+5 <sup>h</sup>	13/17 (13)	30 <sup>g</sup>	10/13	10, 2 ft	10/13
6	.035	0.60	NR	49	20 (19) or 13+5 <sup>h</sup>	15/19 (15)	30 <sup>g</sup>	15/19 (10/13)	10, 4 ft	10/13
7 & 8	0.35	0.60	NR	49	21	19/21 (19)	38 (30) <sup>g</sup>	15/19 (10/13)	10, 4 ft	10/13

<sup>a</sup> **R-values are minimums, U-factors and SHGC are maximums, R-19 batts compressed into a nominal 2 x 6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.**

<sup>b</sup> The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

<sup>c</sup> "15/19" means R-15 continuous insulated sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulated sheathing on the interior or exterior of the home. "10/13" means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

<sup>d</sup> R-5 shall be added to the required slab edge R-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Zones 1 through 3 for heated slabs.

<sup>e</sup> There are no SHGC requirements in the Marine Zone.

<sup>f</sup> Basement wall insulation is not required in warm-humid locations as defined by Figure 301.1 and Table 301.1.

<sup>g</sup> Or insulation sufficient to fill the framing cavity, R-19 minimum.

<sup>h</sup> "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

<sup>i</sup> The second R-value applies when more than half the insulation is on the interior of the mass wall.

<sup>j</sup> For impact rated fenestration complying with Section R301.2.1.2 of the IRC or Section 1608.1.2 of the IBC, maximum U-factor shall be 0.75 in Zone 2 and 0.65 in Zone 3.

# Fenestration

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- An area weighted average of fenestration can be used to satisfy the U-factor & SHGC requirements
    - Area-weighted average U-factor and SHGC are subject to hard limits, even in trade-offs
    - NFRC rated and certified
- Exceptions:
- ↪ Unrated U-factor for single-paned products comply in Zone 1
  - ↪ Unrated U-factor for double-pane with thermal break comply in Zone 2

## Prescriptive Path Only

### ❑ Exemptions

- 15 ft<sup>2</sup> of glazing (Section 402.3.3)
- 24 ft<sup>2</sup> of one side-hinged opaque door assembly (Section 402.3.4)

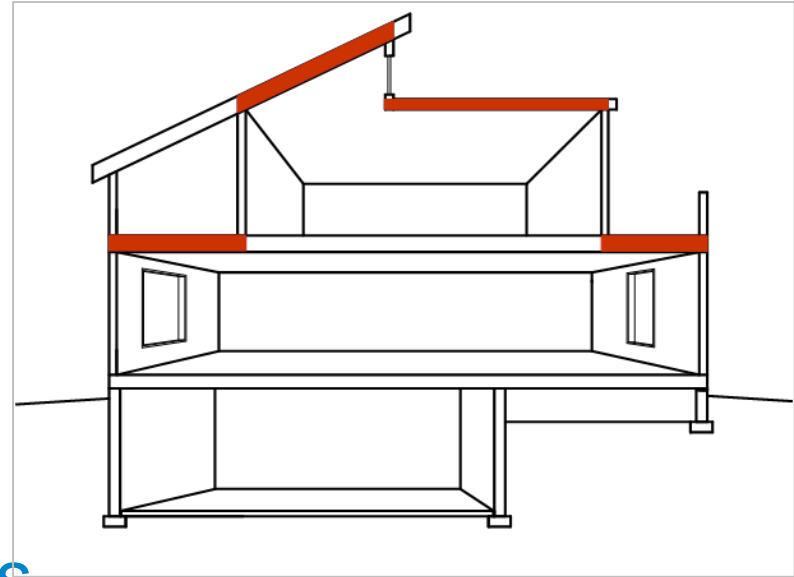
### ❑ Replacement fenestration must meet

- 0.30 SHGC in Climate Zones 1-3
- U-factors in all Zones

# Ceilings

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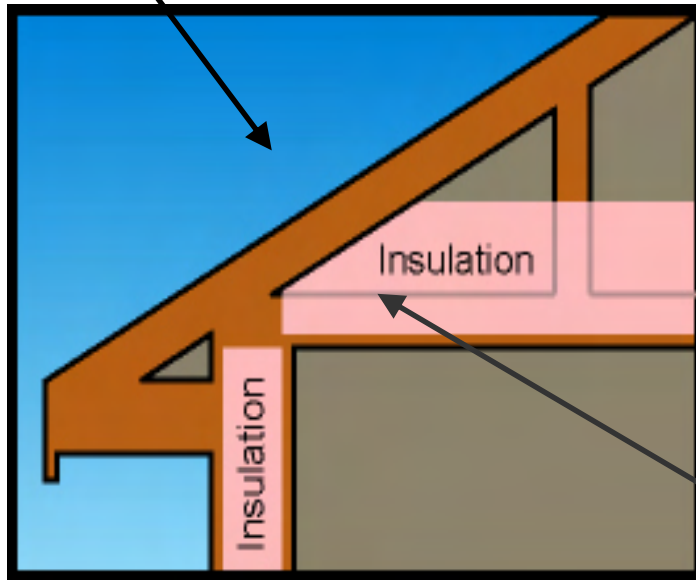
- ❑ Requirements based on
  - Assembly type
  - Continuous insulation
  - Insulation between framing
  
- ❑ Meet or exceed R-values



# Standard Roof Truss

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Possibility of ice dam formations



- ❑ Ceiling insulation code requirements assume standard truss systems

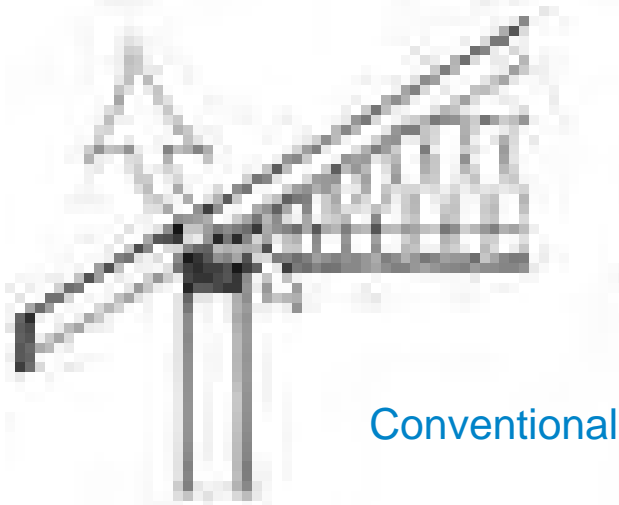
Cold corners contribute to condensation and mold growth

# Raised Heel Truss

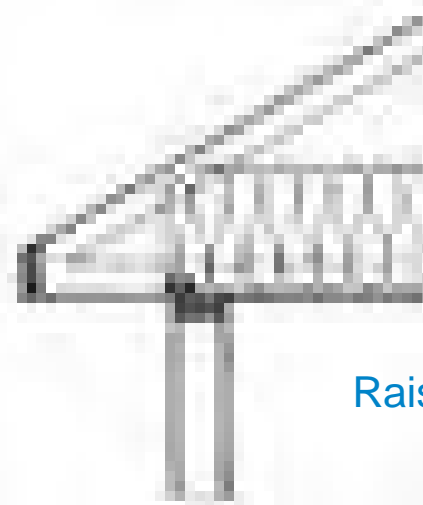
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- ❑ Raised Heel/Energy Truss credit if insulation is full height over exterior wall (*Prescriptive*)
  - R-30 instead of R-38
  - R-38 instead of R-49



Conventional



Raised heel

## Ceilings without Attic Spaces (Prescriptive)

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### □ Where

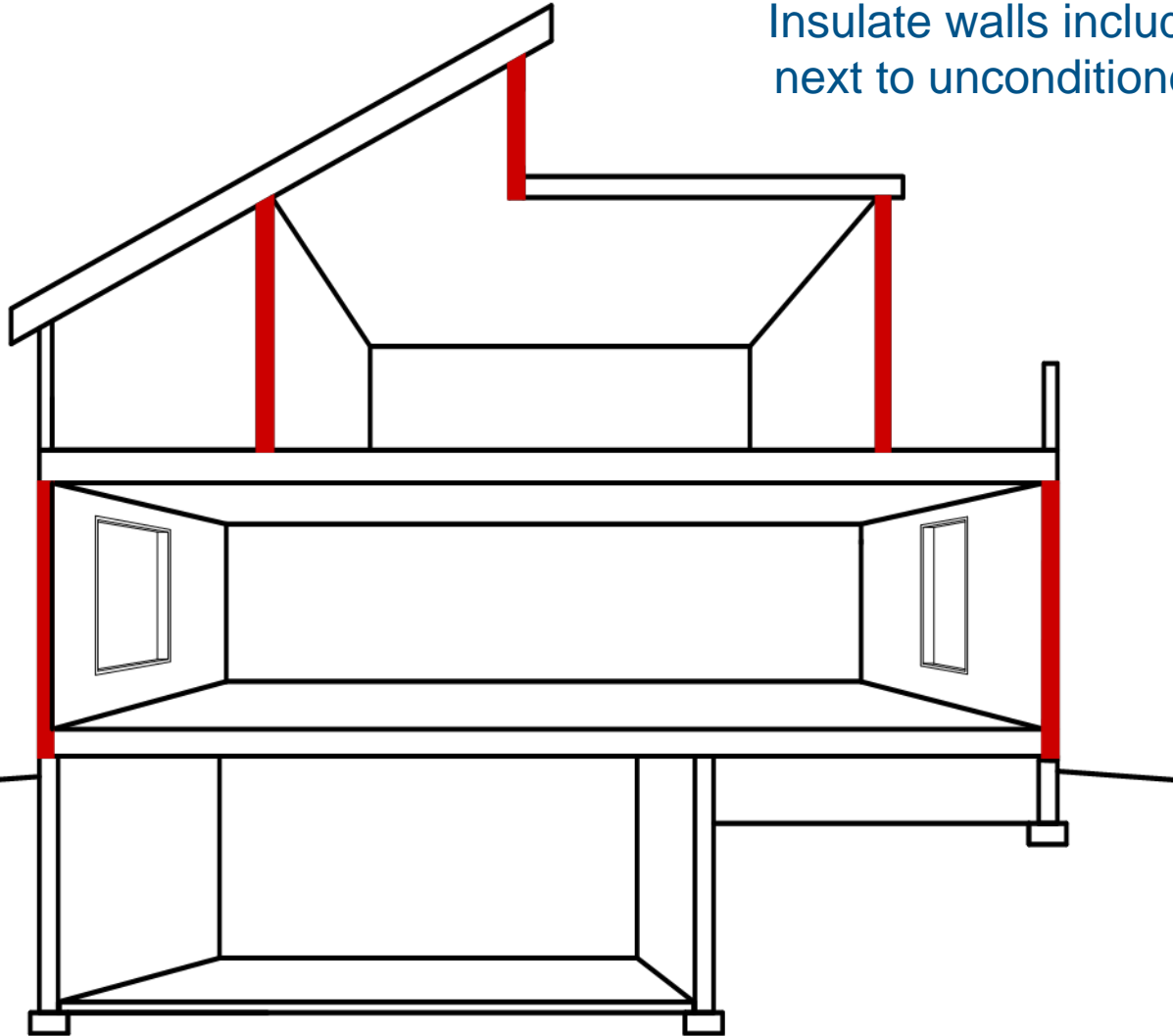
- Insulation levels are required  $> R-30$  and
- Not sufficient amount of space to meet higher levels
  - ↪  $R-30$  allowed for  $500 \text{ ft}^2$  or 20% total insulated ceiling area, whichever is less

# Above Grade Walls

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Insulate walls including those next to unconditioned spaces

Don't forget to insulate rim joists



# Mass Walls

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## □ What type

- Concrete block, concrete, insulated concrete form (ICF), masonry cavity, brick (other than brick veneer), earth, and solid timber/logs

## □ Provisions

- At least 50% of the required R-value must be on the exterior or integral to the wall
- When more than half the insulation is on the interior, the mass wall U-factors:

Climate Zones	U-Factor Maximum
1	0.17
2	0.14
3	0.12
4 except Marine	0.10
4 Marine	same as above grade frame wall
5-8	same as above grade frame wall



**Table 402.2.5**  
**Steel-Frame Ceiling, Wall and Floor Insulation**  
**(R-Value)**

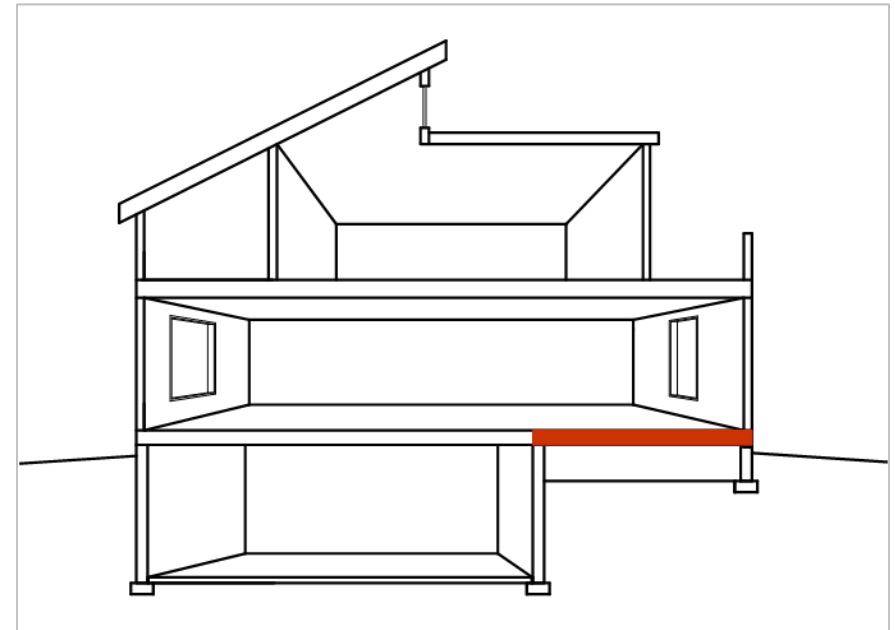
- ❑ Ceilings, walls, and floors
- ❑ Exceptions
  - Climate Zones 1 and 2 ci can be reduced to R-3 for 24" o.c. walls

Wood Frame R-value	Cold-Formed Steel Equivalent R-value <sup>a</sup>
<b>Steel Truss Ceilings<sup>b</sup></b>	
R-30	R-38 or R-30 + 3 or R-26 + 5
R-38	R-49 or R-38 + 3
R-49	R-38 + 5
<b>Steel Joist Ceilings<sup>b</sup></b>	
R-30	R-38 in 2x4, or 2x6, or 2x8 R-49 any framing
R-38	R-49 2x4, or 2x6, or 2x8, or 2x10
<b>Steel Framed Wall</b>	
R-13	R-13 + 5 or R-15 +4, or R-21 +3 or R-0+10
R-19	R-13 + 9 or R-19 +8 or R-25 +7
R-21	R-13 +10 or R-19 +9 or R-25 +8
<b>Steel Joist Floor</b>	
R-13	R-19, 2x6 R-19 + 6 in 2x8 or 2x10
R-19	R-19 + 6 in 2x6 R-19 +12 in 2x8 or 2x10

# Floors over Unconditioned Space

- Space can be unheated basement or a crawlspace or outdoor air

Climate Zones	R-Value
1-2	13
3-4ab	19
4c-6	30*
7-8	38*



\*Exception:

Climate Zones 4c-8

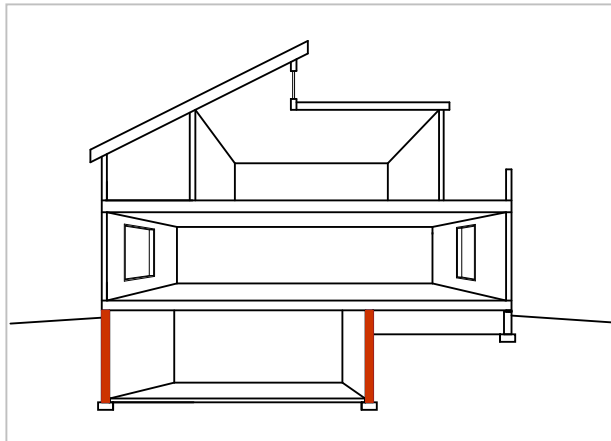
R-19 permitted if cavity completely filled

- Insulation must maintain permanent contact with underside of subfloor

# Below-Grade Walls

□  $\geq 50\%$  below grade

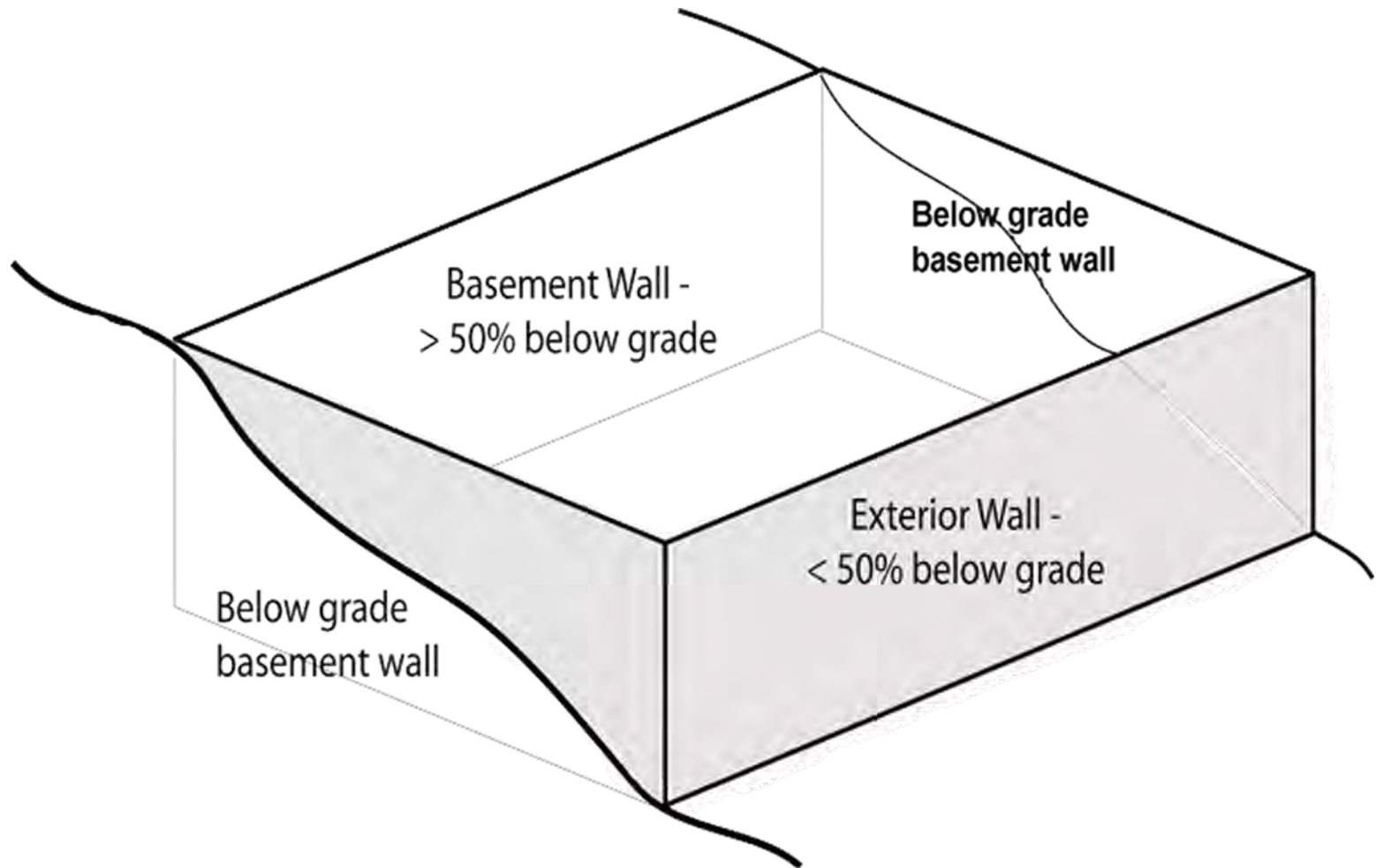
Climate Zones	R-Value
1-2	0
3	5/13
4-5	10/13
6-8	15/19



**Insulated from top of basement wall down to 10 ft below grade or basement floor, whichever is less**

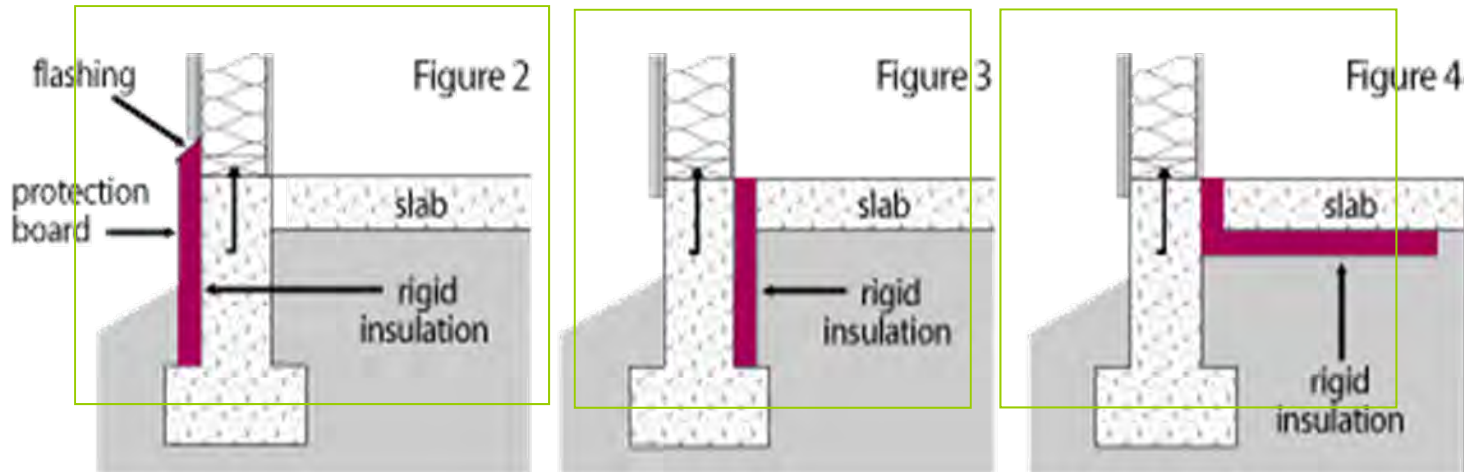
# Defining Below-Grade Walls

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# Slab Edge Insulation

- ❑ Slabs with a floor surface < 12 inches below grade
  - R-10 (typically 2 inches) insulation in Zones 4 and above
  - Downward from top of slab a minimum of 24" (Zones 4 and 5) or 48" (Zones 6, 7, and 8)
  - Insulation can be vertical or extend horizontally under the slab or out from the building (must be under 10 inches of soil)



# Slab Edge Insulation

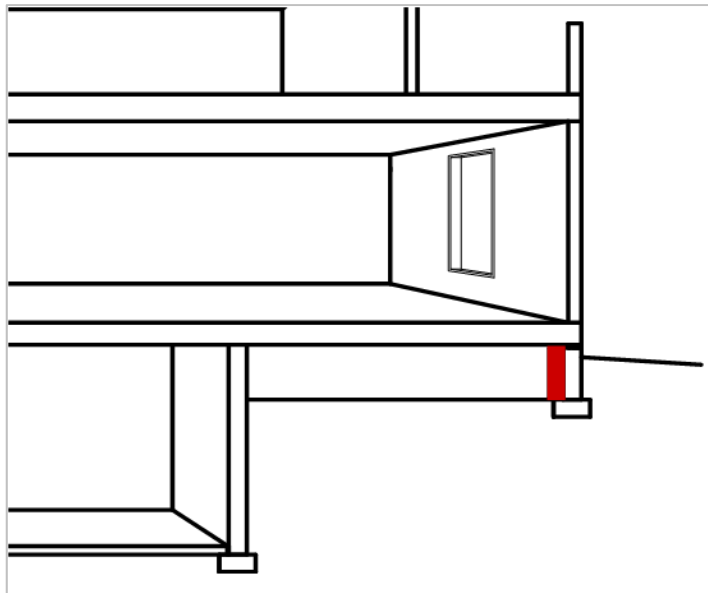
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# Crawlspace Wall Insulation

## ❑ Unvented Crawlspace

- Space should be mechanically vented or conditioned (See Section R408 of the IRC)
- Cover exposed earth with a continuous Class I vapor retarder



# Vented & Unvented Crawlspace

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## Vented Crawlspace Requirements:

- ❑ The raised floor over the crawlspace must be insulated.
- ❑ A vapor retarder may be required as part of the floor assembly.
- ❑ Ventilation openings must exist that are equal to at least 1 square foot for each 150 square feet of crawlspace area and be placed to provide cross-flow (*IRC 408.1, may be less if ground vapor retarder is installed*).
- ❑ Ducts in crawlspace must be sealed and have R-8 insulation.

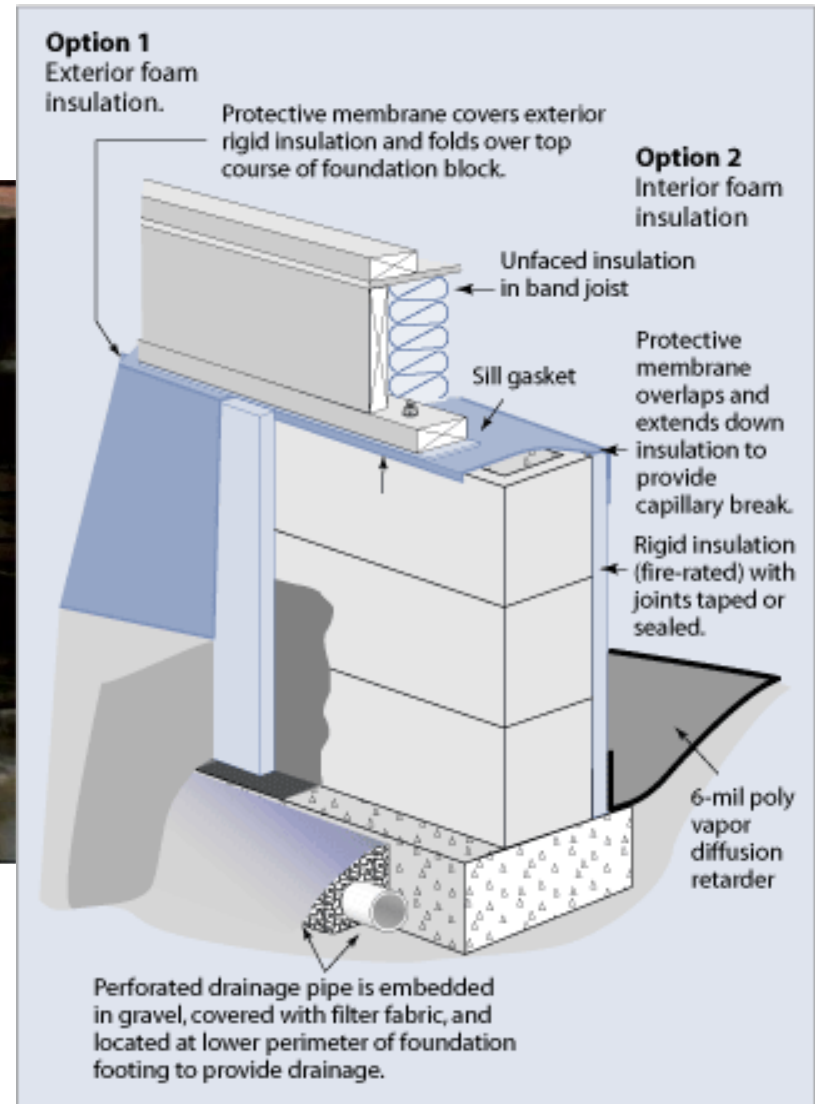
## Unvented Crawlspace Requirements:

- ❑ The crawlspace ground surface must be covered with an approved vapor retarder (*e.g., plastic sheeting*).
- ❑ Crawlspace walls must be insulated to the R-value requirements specific for crawlspace walls (*IECC Table 402.1.1*).
- ❑ Crawlspace wall insulation must extend from the top of the wall to the inside finished grade and then 24" vertically or horizontally.
- ❑ Crawlspace must be mechanically vented (*1 cfm exhaust per 50 square feet*) or conditioned (*heated and cooled*).

# Vented & Unvented Crawlspaces

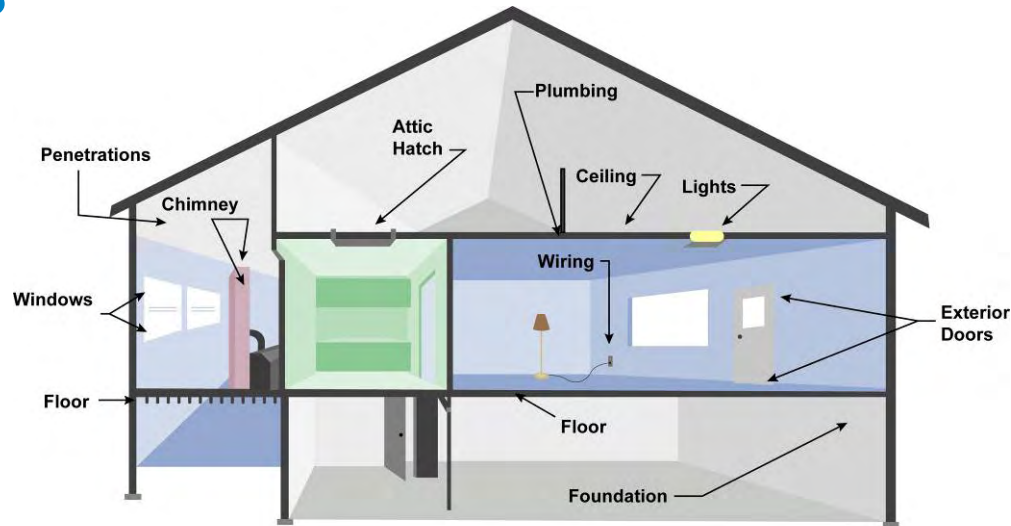


Polyethylene is widely used as a crawl space ground cover.



# Mandatory Requirements Building Envelope

- ❑ Air leakage
- ❑ Recessed lighting
- ❑ Maximum fenestration U-factor and SHGC
- ❑ Fireplaces



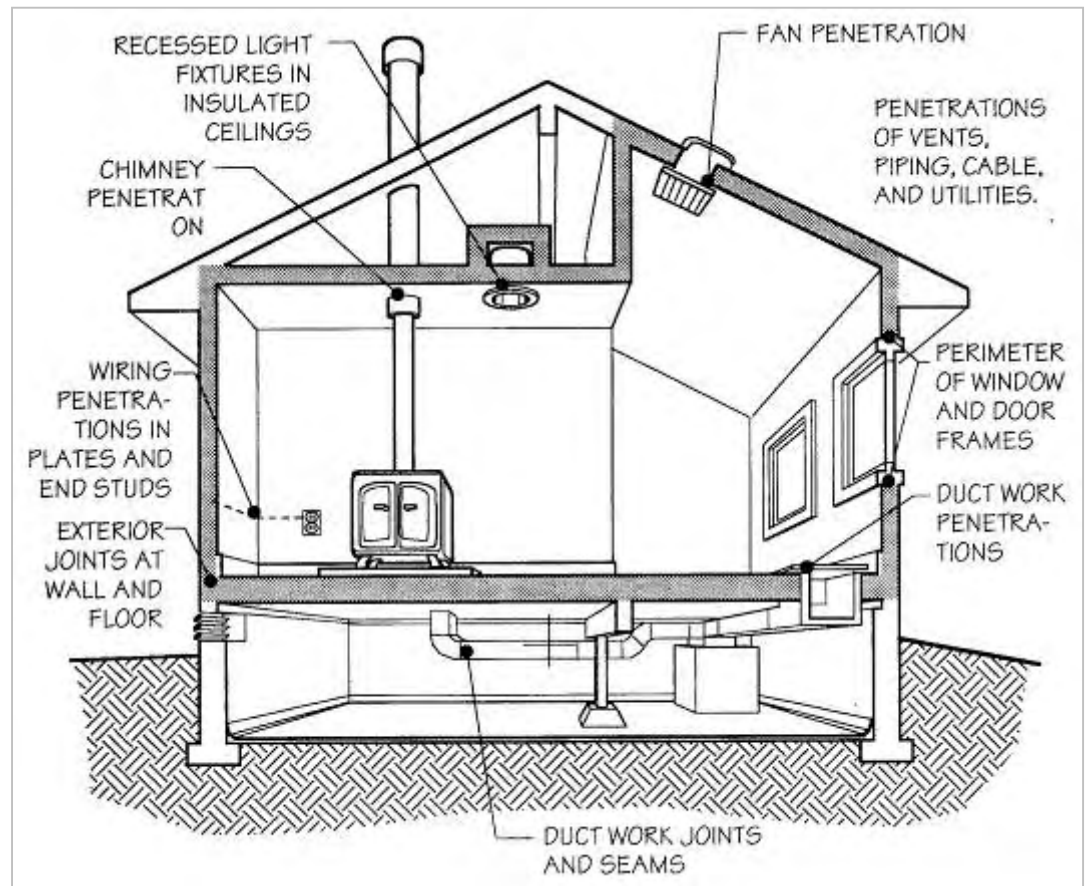
## □ Building envelope

- Sealed with caulking materials or
- Closed with gasketing systems
- Joints and seams sealed or taped
- Air permeable insulation is not used as air sealing material



# Areas for Air Leakage (Infiltration)

- ❑ Windows and doors
- ❑ Between sole plates
- ❑ Floors and exterior wall panels
- ❑ Plumbing
- ❑ Electrical
- ❑ Service access doors or hatches
- ❑ Recessed light fixtures
- ❑ Rim joist junction



# Recessed Lighting Fixtures

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## Mandatory Requirements

- ❑ Type IC rated and labeled in a sealed or gasketed enclosure
- ❑ Type IC rated and labeled as meeting ASTM E 283 when tested at 1.57 psf (75 Pa) pressure differential with no more than 2.0 cfm of air movement
- ❑ Sealed with a gasket or caulk between the housing and interior wall or ceiling covering



- 2 options to demonstrate compliance
  - When tested air leakage is  $<7$  ACH when tested with a blower door at pressure of 33.5 psf (50 pa) (Section 402.4.2.1)
    - ↳ Testing after rough in and installation of building envelope penetrations
  - When items listed in Table 402.4.2, applicable to the method of construction, are field verified (Section 402.4.2.2)

# Air Sealing and Insulation

Table 2: 2009 IECC 402.4.2 "Visual Inspection List for Air Sealing and Insulation Compliance"

Component	Criteria
Air barrier and thermal barrier	Exterior thermal envelope insulation for framed walls is installed in substantial contact and continuous alignment with building envelope air barrier. Breaks or joints in the air barrier are filled or repaired. Air permeable insulation is not used as a sealing material. Air permeable insulation is inside of an air barrier.
Ceiling/attic	Air barrier in any dropped ceiling/soffit is substantially aligned with insulation and any gaps are sealed. Attic access (except unvented attic), knee wall door, or drop down stair is sealed.
Walls	Corners and headers are insulated. Junction of foundation and sill plate is sealed.
Windows and doors	Space between window/door jams and framing is sealed.
Rim joists	Rim joists are insulated and include air barrier.
Floors (including above garage and cantilevered floors)	Insulation is installed to maintain permanent contact with underside of subfloor decking. Air barrier is installed at any exposed edge of insulation.
Crawl space walls	Insulation is permanently attached to walls. Exposed earth in unvented crawl space is covered with class I vapor retarder with overlapping joints taped.
Shafts, penetrations	Duct shafts, utility penetrations, knee walls, and flue shafts opening to exterior or unconditioned space are sealed.
Narrow cavities	Batts in narrow cavities are cut to fit, or narrow cavities are filled by sprayed/blown insulation.
Garage separation	Air sealing is provided between the garage and conditioned spaces.
Recessed lighting	Recessed light fixtures are airtight, IC rated, and sealed to drywall. Exception – fixtures in conditioned space.
Plumbing and wiring	Insulation is placed between outside and pipes. Batt insulation is cut to fit around wiring and plumbing, or sprayed/blown insulation extends behind piping and wiring.
Shower/tub on exterior wall	Showers and tubs on exterior walls have insulation and air barrier separating them from the exterior wall.
Electrical/phone box on exterior walls	Air barrier extends behind boxes or air sealed-type boxes are installed.
Common wall	Air barrier is installed in common wall between dwelling units.
HVAC register boots	HVAC register boots that penetrate building envelope are sealed to subfloor or drywall.
Fireplace	Fireplace walls include an air barrier.



- ❑ Strict limits on U-factor in northern U.S. (cannot be traded off)

<b>Climate Zones</b>	<b>U-Factor Maximum</b>
4-5	0.48
6-8	0.40

- U-0.75 for skylights in Zones 4-8
- These are based on building average; individual windows or skylights can be worse if area-weighted average meets these requirements

## □ Solar Heat Gain Coefficient

### ➤ Climate Zones 1-3

↳ 0.30 or lower (area-weighted average)

↳ Cannot exceed 0.50 even if performance path trade-offs are used (area-weighted average)

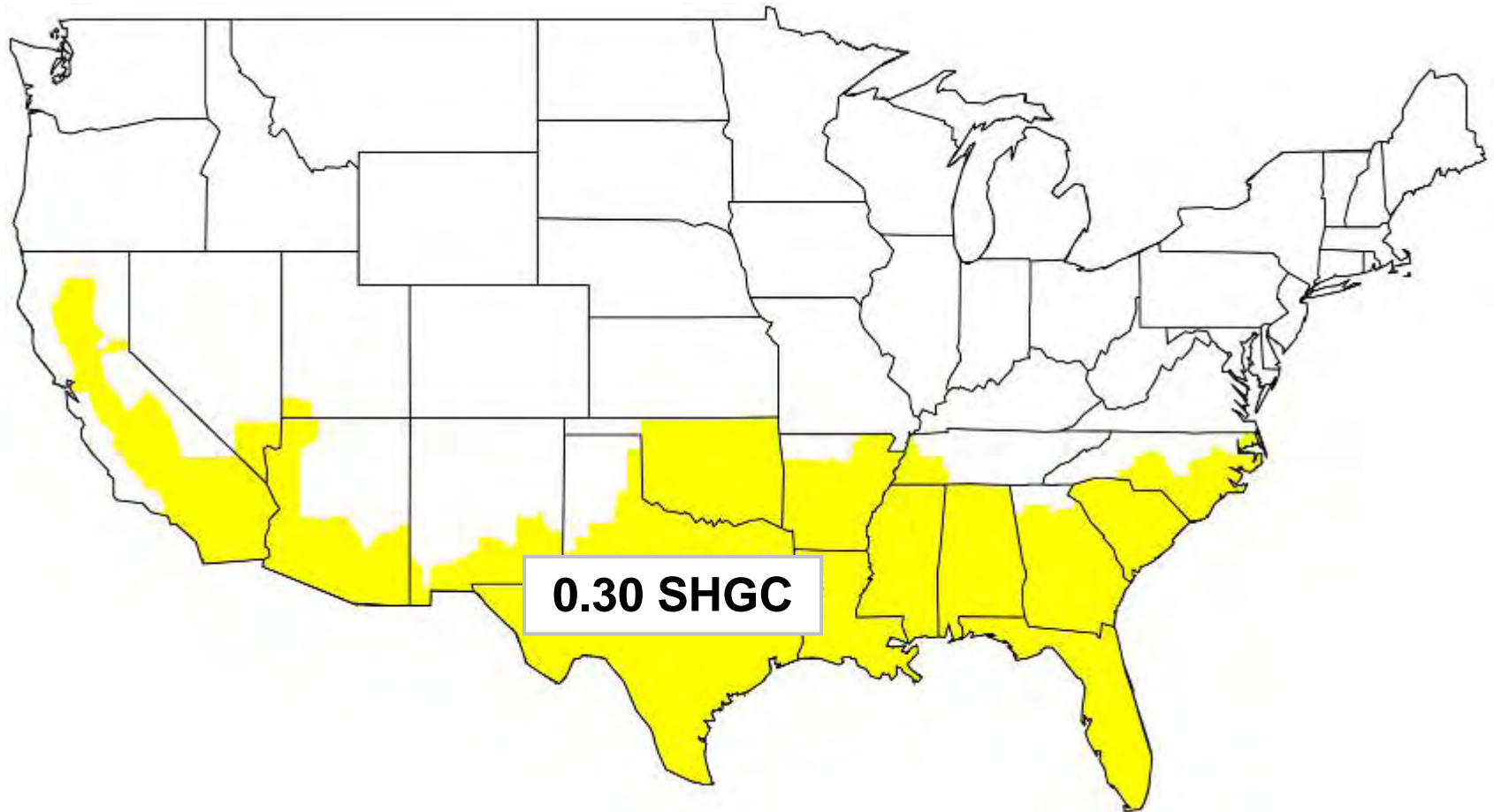
### ➤ National Fenestration Rating Council (NFRC) tested

### Solar Heat Gain Coefficient



# Locations with Window SHGC Requirements

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# Mechanical Systems & Equipment

- ❑ Equipment efficiency set by Federal law, not the I-Codes



# Mandatory Requirements Systems

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## (Section 403)

- ❑ Controls
- ❑ Heat pump supplementary heat
- ❑ Ducts
  - Sealing (Mandatory)
  - Insulation (Prescriptive)
- ❑ HVAC piping insulation
- ❑ Circulating hot water systems
- ❑ Ventilation
- ❑ Equipment sizing
- ❑ Systems serving multiple dwelling units
- ❑ Snow melt controls
- ❑ Pools

## ❑ Insulation (Prescriptive)

- Ducts outside the building envelope: R-8
- All other ducts: R-6

## ❑ Sealing (Mandatory)

- Joints and seams shall comply with IRC, Section M1601.4.1

## ❑ Building framing cavities shall not be used as supply ducts

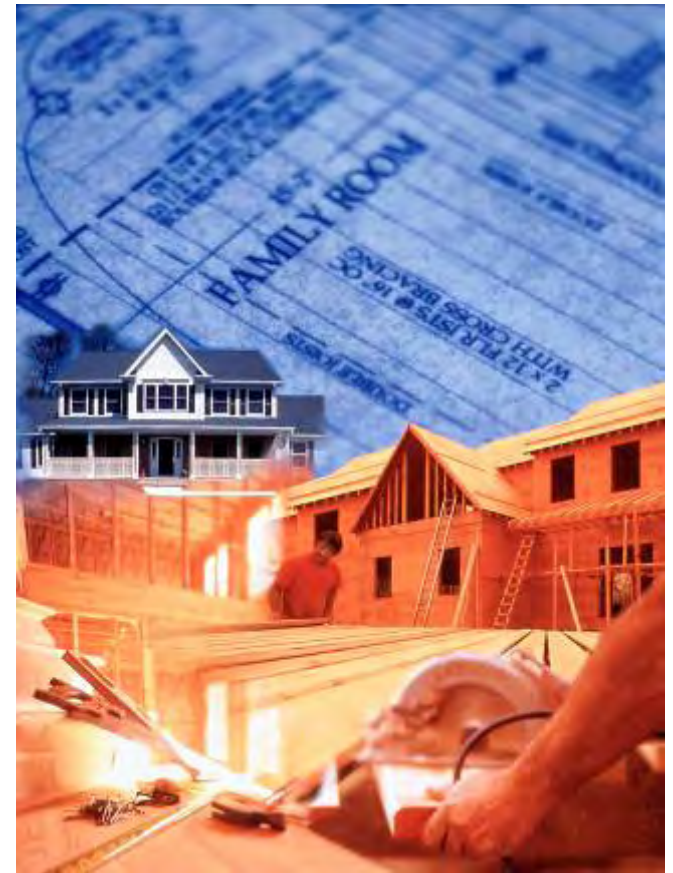


- ❑ Duct tightness shall be verified *by either* –
  - Post construction test
    - ↳ Leakage to outdoors:  $\leq 8$  cfm/per 100 ft<sup>2</sup> of conditioned floor area **or**
    - ↳ Total leakage:  $\leq 12$  cfm/per 100 ft<sup>2</sup> of conditioned floor area
      - ↳ tested at a pressure differential of 0.1 in w.g. (25Pa) across entire system, including manufacturer's air handler enclosure
    - ↳ All register boots taped or otherwise sealed
  - Or Rough-in test
    - ↳ Total leakage  $\leq 6$  cfm/per 100 ft<sup>2</sup> of conditioned floor area
      - ↳ tested at a pressure differential of 0.1 in w.g. (25Pa) across roughed-in system, including manufacturer's air handler enclosure
      - ↳ all register boots taped or otherwise sealed
      - ↳ if air handler not installed at time of test
        - ↳ Total air leakage  $\leq 4$  cfm/per 100 ft<sup>2</sup>

**Exceptions: Duct tightness test is not required if the air handler and all ducts are located within conditioned space**

# Compliance/Documentation/Inspections

- ❑ Code Official has final authority
  - Software, worksheets
  - Above Code Programs
- ❑ Electronic media can be used
- ❑ Construction work for which a permit is required is subject to inspection
- ❑ Certificate is required



# Home Energy Ratings – Requirements by Zone

**Table 402.1.1**  
**Insulation and Fenestration Requirements by Component<sup>a</sup>**  
 (numbers in parenthesis are for 2006 IECC requirements)

Climate Zone	Fenestration U-Factor <sup>b</sup>	Skylight <sup>b</sup> U-Factor	Glazed Fenestration SHGC <sup>b, c</sup>	Ceiling Value	Wood Frame Wall R-Value	Mass Wall R-Value <sup>d</sup>	Floor R-Value	Basement <sup>e</sup> Wall R-Value	Slab <sup>f</sup> R-Value & Depth	Crawl Space <sup>g</sup> Wall R-Value
1	1.2	0.75	0.30 (0.40)	30	13	3/4 (3)	13	0	0	0
2	0.65 <sup>i</sup> (0.75)	0.75	0.30 (0.40)	30	13	4/6 (4)	13	0	0	0
3	0.50 <sup>i</sup> (0.65)	0.65	0.30 (0.40)	30	13	5/8 (5)	19	5/13 <sup>j</sup> (0)	0	5/13
4 except Marine	0.35 (0.40)	0.60	NR	38	13	5/10 (5)	19	10/13	10, 2 ft	10/13
5 & Marine 4	0.35	0.60	NR	38	20 (19) or 13+5 <sup>h</sup>	13/17 (13)	30 <sup>g</sup>	10/13	10, 2 ft	10/13
6	.035	0.60	NR	49	20 (19) or 13+5 <sup>h</sup>	15/19 (15)	30 <sup>g</sup>	15/19 (10/13)	10, 4 ft	10/13
7 & 8	0.35	0.60	NR	49	21	19/21 (19)	38 (30) <sup>g</sup>	15/19 (10/13)	10, 4 ft	10/13

<sup>a</sup> R-values are minimums, U-factors and SHGC are maximums, R-19 batts compressed into a nominal 2 x 6 framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value.

<sup>b</sup> The fenestration U-factor column excludes skylights. The SHGC column applies to all glazed fenestration.

<sup>c</sup> "15/19" means R-15 continuous insulated sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulated sheathing on the interior or exterior of the home. "10/13" means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.

<sup>d</sup> R-5 shall be added to the required slab edge R-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Zones 1 through 3 for heated slabs.

<sup>e</sup> There are no SHGC requirements in the Marine Zone.

<sup>f</sup> Basement wall insulation is not required in warm-humid locations as defined by Figure 301.1 and Table 301.1.

<sup>g</sup> Or insulation sufficient to fill the framing cavity, R-19 minimum.

<sup>h</sup> "13+5" means R-13 cavity insulation plus R-5 insulated sheathing. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.

<sup>i</sup> The second R-value applies when more than half the insulation is on the interior of the mass wall.

<sup>j</sup> For impact rated fenestration complying with Section R301.2.1.2 of the IRC or Section 1608.1.2 of the IBC, maximum U-factor shall be 0.75 in Zone 2 and 0.65 in Zone 3.

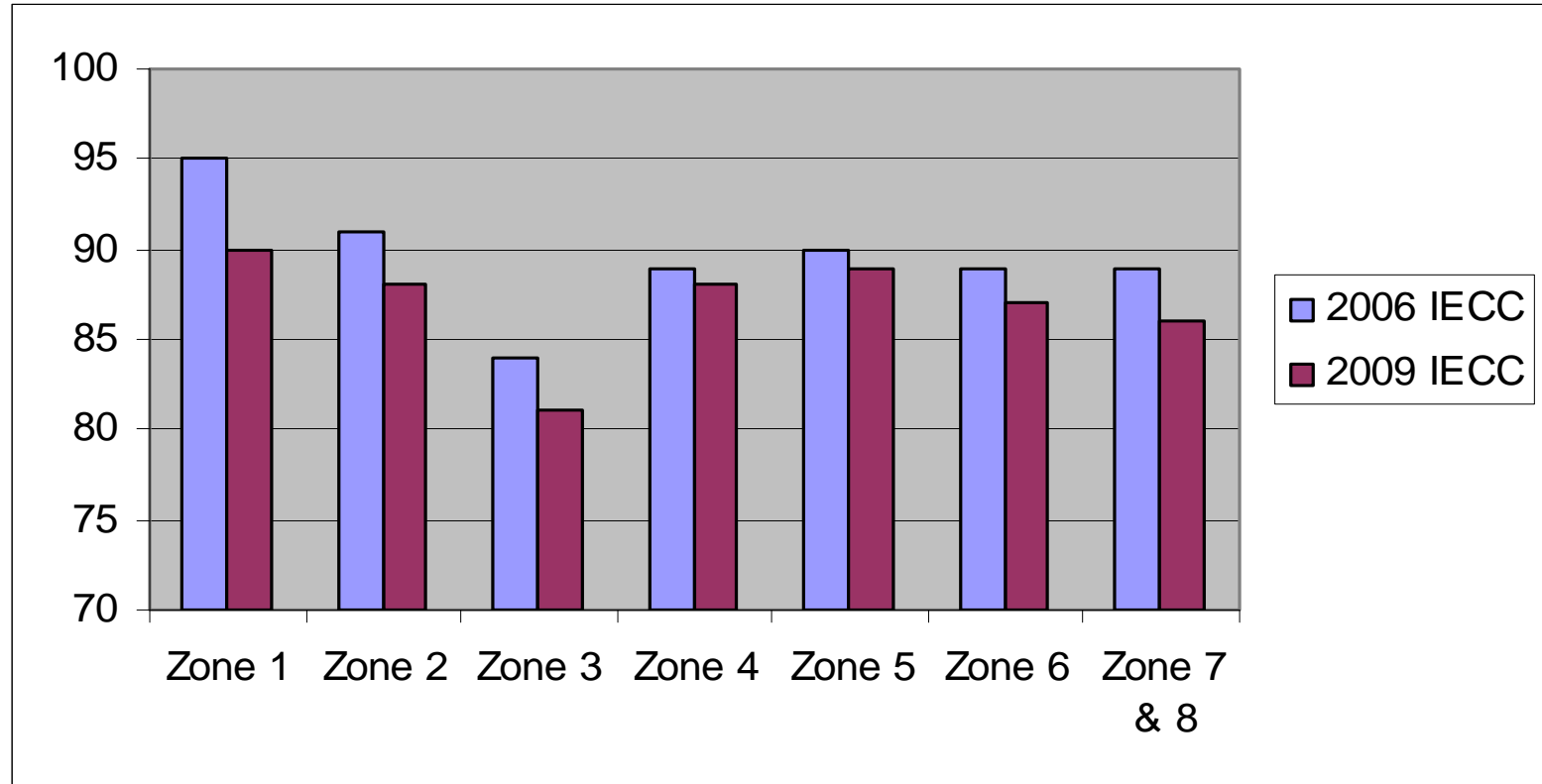
# Home Energy Ratings – Assumptions Scenario 1

Zone 1	2 story single family home slab on grade, Miami, FL with 2225ft <sup>2</sup> conditioned space
Zone 2	2 story single family home slab on grade, Houston, TX with 2225ft <sup>2</sup> conditioned space
Zone 3	2 story single family home crawl space, Charlotte, NC with 2225ft <sup>2</sup> conditioned space
Zone 4	2 story single family home with basement, St. Louis, MO with 3510ft <sup>2</sup> conditioned space
Zone 5	2 story single family home with basement, Detroit, MI with 3510ft <sup>2</sup> conditioned space
Zone 6	2 story single family home with basement, Minneapolis, MN with 3510ft <sup>2</sup> conditioned space
Zone 7 & 8	2 story single family home with basement, Fairbanks, AK with 3510ft <sup>2</sup> conditioned space
General	<ul style="list-style-type: none"><li>• <b>Meeting 2006 or 2009 IECC, 17.5% window/wall ratio</b></li><li>• <b>Default duct leakage and 0.35 NACH for all zones</b></li></ul>

## Home Energy Ratings – HERS Ratings Scenario 1: 0.35 NACH, default duct leakage

	<b>2006 IECC</b>	<b>2009 IECC</b>
<b>Zone 1 (SHGC 0.4 to 0.3)</b>	<b>95</b>	<b>90</b>
<b>Zone 2 (SHGC 0.4 to 0.3, U 0.75 to 0.65)</b>	<b>91</b>	<b>88</b>
<b>Zone 3 (SHGC 0.4 to 0.3, U 0.65 to 0.5)</b>	<b>84</b>	<b>81</b>
<b>Zone 4 (U 0.4 to 0.35)</b>	<b>89</b>	<b>88</b>
<b>Zone 5 (R19 to R13+R5)</b>	<b>90</b>	<b>89</b>
<b>Zone 6 (R19 to R13+R5 above grade, R10 to R15 below grade)</b>	<b>89</b>	<b>87</b>
<b>Zone 7 &amp; 8 (R10 to R15 below grade)</b>	<b>89</b>	<b>86</b>

# Home Energy Ratings – HERS Ratings Scenario 1



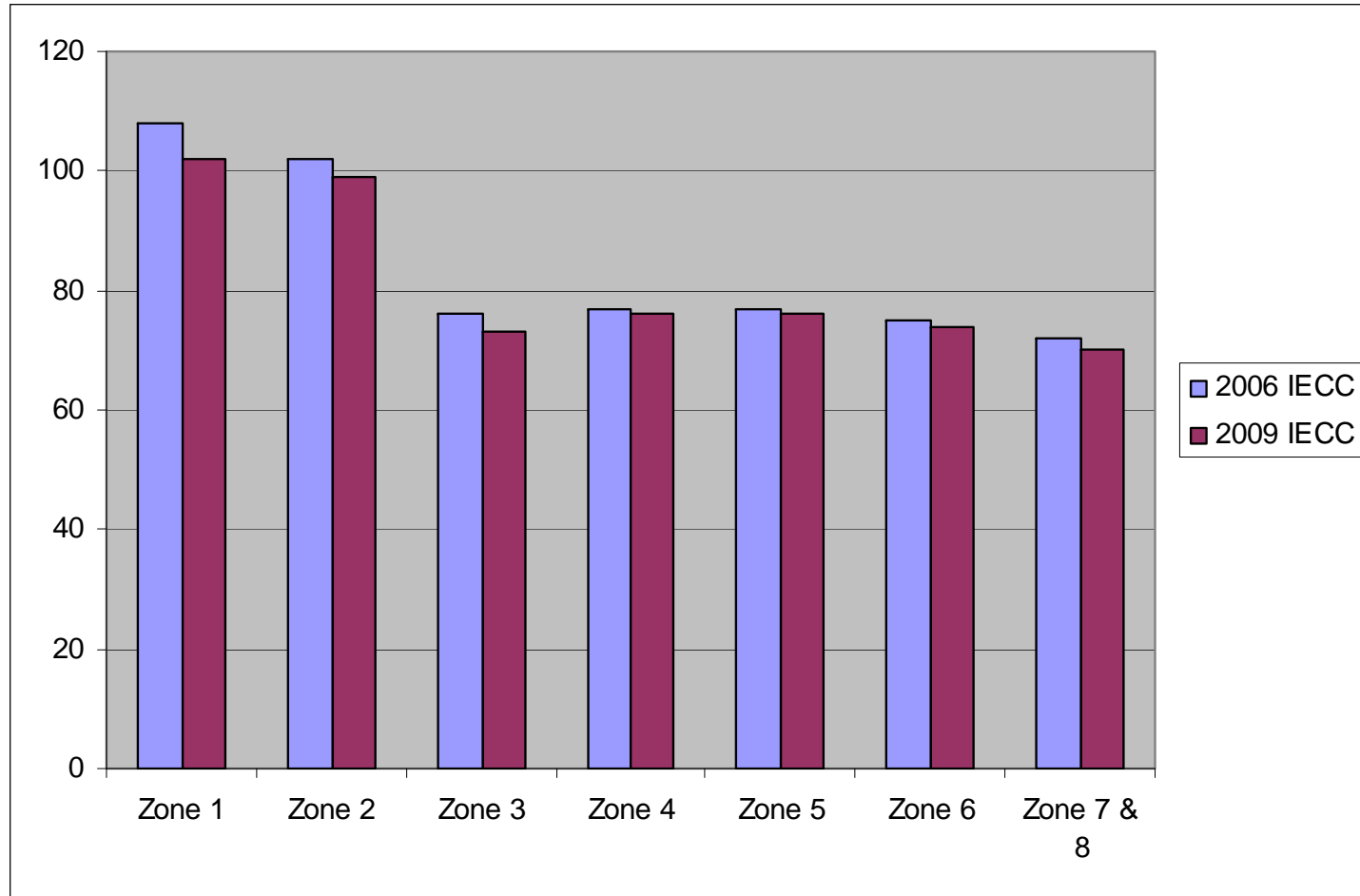
# Home Energy Ratings – Assumptions Scenario 2

Zone 1	2 story single family home slab on grade, Miami, FL with 2225ft <sup>2</sup> conditioned space
Zone 2	2 story single family home slab on grade, Houston, TX with 2225ft <sup>2</sup> conditioned space
Zone 3	2 story single family home crawl space, Charlotte, NC with 2225ft <sup>2</sup> conditioned space
Zone 4	2 story single family home with basement, St. Louis, MO with 3510ft <sup>2</sup> conditioned space
Zone 5	2 story single family home with basement, Detroit, MI with 3510ft <sup>2</sup> conditioned space
Zone 6	2 story single family home with basement, Minneapolis, MN with 3510ft <sup>2</sup> conditioned space
Zone 7 & 8	2 story single family home with basement, Fairbanks, AK with 3510ft <sup>2</sup> conditioned space
General	<ul style="list-style-type: none"><li>• Meeting 2006 or 2009 IECC, 17.5% window/wall ratio</li><li>• Meeting 2009 IECC duct leakage and blower door test requirements:<ul style="list-style-type: none"><li>• Duct leakage to outside: 8 cfm/100 ft<sup>2</sup></li><li>• Blower door results: 7 ACH</li></ul></li></ul>

## Home Energy Ratings – HERS Ratings Scenario 2: 7 ACH at 50pa, 8 cfm/100 ft<sup>2</sup> conditioned space

	<b>2006 IECC</b>	<b>2009 IECC</b>
<b>Zone 1 (SHGC 0.4 to 0.3)</b>	<b>108</b>	<b>102</b>
<b>Zone 2 (SHGC 0.4 to 0.3, U 0.75 to 0.65)</b>	<b>102</b>	<b>99</b>
<b>Zone 3 (SHGC 0.4 to 0.3, U 0.65 to 0.5)</b>	<b>76</b>	<b>73</b>
<b>Zone 4 (U 0.4 to 0.35)</b>	<b>77</b>	<b>76</b>
<b>Zone 5 (R19 to R13+R5)</b>	<b>77</b>	<b>76</b>
<b>Zone 6 (R19 to R13+R5, R10 to R15 below grade)</b>	<b>75</b>	<b>74</b>
<b>Zone 7 &amp; 8 (R10 to R15 below grade)</b>	<b>72</b>	<b>70</b>

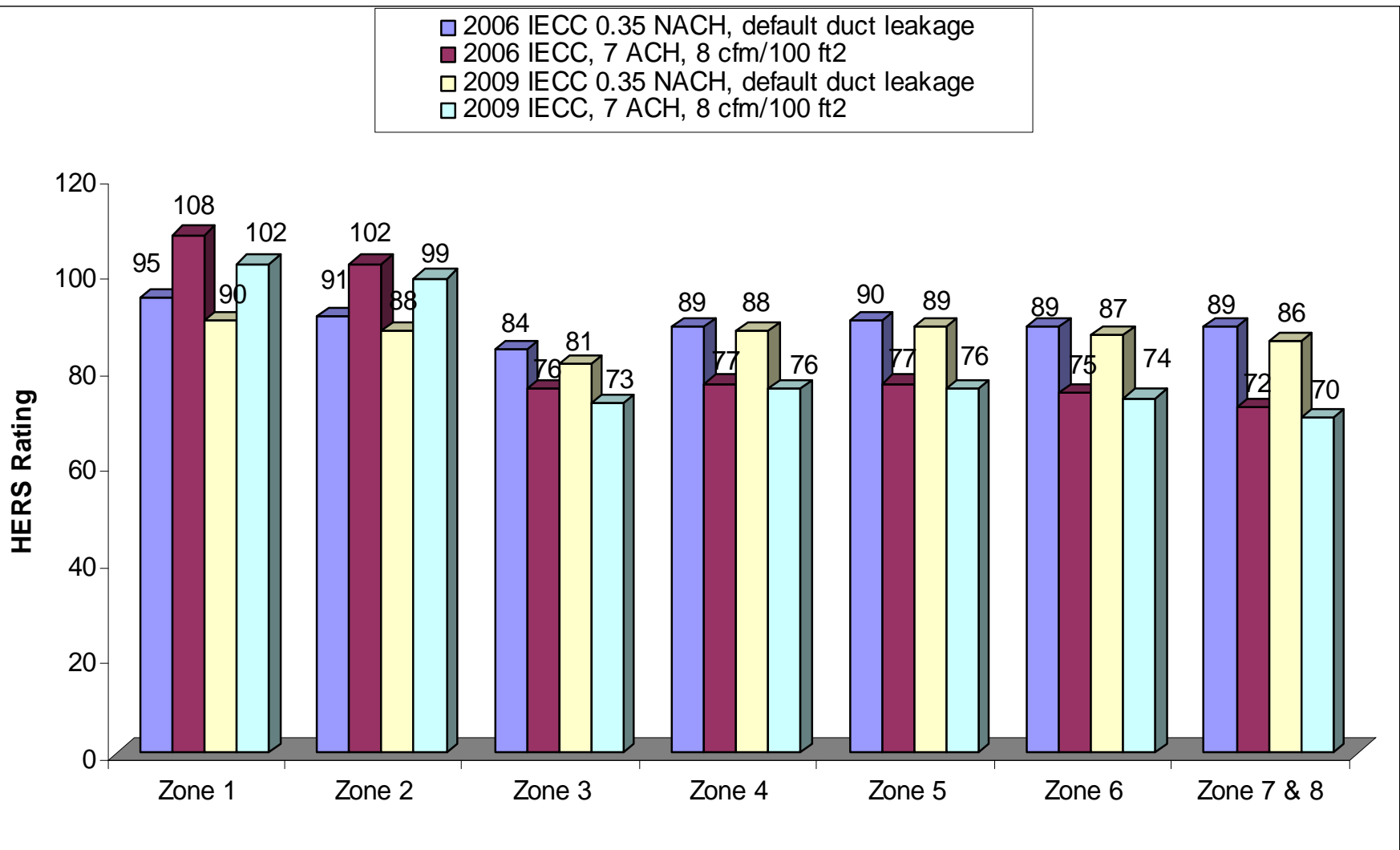
# Home Energy Ratings – HERS Ratings Scenario 2



# Home Energy Ratings – HERS Ratings Scenario 1 vs. 2

	2006 IECC		2009 IECC	
	Scenario 1: 0.35 NACH, Default Duct leakage	Scenario 2: 7 ACH, 8 cfm/100ft <sup>2</sup>	Scenario 1: 0.35 NACH, Default Duct leakage	Scenario 2: 7 ACH, 8 cfm/100ft <sup>2</sup>
<b>Zone 1</b>	95	108	90	102
<b>Zone 2</b>	91	102	88	99
<b>Zone 3</b>	84	76	81	73
<b>Zone 4</b>	89	77	88	76
<b>Zone 5</b>	90	77	89	76
<b>Zone 6</b>	89	75	87	74
<b>Zone 7 &amp; 8</b>	89	72	86	70

# Home Energy Ratings – Air Leakage Impact



# Home Energy Ratings - Findings

- ❑ Improved ratings for all climate zones for 2009 IECC
- ❑ The extent of rating increase is consistent with the extent of 2009 improvements
- ❑ Different house can have different results
- ❑ Duct leakage and blower door test results play important roles on home ratings
- ❑ IECC requirements are MINIMUM requirements
- ❑ For Zone 3 and above, the newly required duct leakage and blower door test dramatically improve home ratings



**Dow Building Solutions**

Questions?