



CSI Boston Chapter  
Thursday, May 14, 2014

## **Understanding roofing-related code requirements**

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National Roofing Contractors Association



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## **International Code Council (ICC)**

Massachusetts adoptions

### **Massachusetts**

#### **State Adoptions**

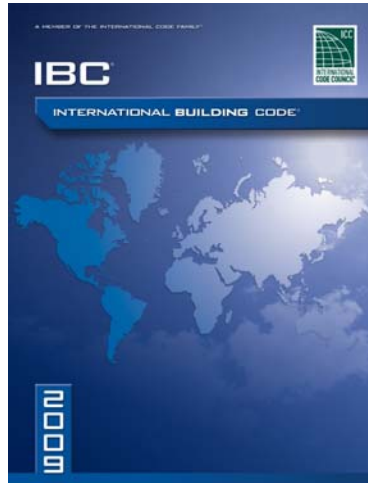
MA state code is based on the 2009 IBC, IEBC, IMC and the 2012 IECC. There are references to the 2009 IFC.

- 2009 International Building Code
- 2012 International Energy Conservation Code
- 2009 International Existing Building Code
- 2009 International Mechanical Code
- 2009 International Residential Code
- 2009 International Residential Code

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## ***International Building Code, 2009 Edition (IECC 2009)***



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### **Scope of roofing chapter**

IBC 2009, Section 1501-General

**1501.1 Scope.** The provisions of this chapter shall govern the design, materials, construction and quality of roof assemblies, and rooftop structures.

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## Reroofing

IBC 2009, Section 1510-Reroofing

**1510.1 General.** Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15.

**Exception:** Reroofing shall not be required to meet the minimum design slope requirement of one-quarter unit vertical in 12 units horizontal (2-percent slope) in Section 1507 for roofs that provide positive roof drainage.

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## Roof drainage

IBC 2009, Section 1503.4-Roof Drainage

**1503.4 Roof drainage.** Design and installation of roof drainage systems shall comply with Section 1503 and the *International Plumbing Code*.

**1503.4.1 Secondary drainage required.** Secondary (emergency) roof drains or scuppers shall be provided where the roof perimeter construction extends above the roof in such a manner that water will be entrapped if the primary drains allow buildup for any reason.

**1503.4.2 Scuppers.** When scuppers are used for secondary (emergency overflow) roof drainage, the quantity, size, location and inlet elevation of the scuppers shall be sized to prevent the depth of ponding water from exceeding that for which the roof was designed as determined by Section 1503.4.1. Scuppers shall not have an opening dimension of less than 4 inches (102 mm). The flow through the primary system shall not be considered when locating and sizing scuppers.

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## **Crickets and saddles**

IBC 2009, Section 1503.6-Crickets and Saddles

**1503.6 Crickets and saddles.** A cricket or saddle shall be installed on the ridge side of any chimney or penetration greater than 30 inches (762 mm) wide as measured perpendicular to the slope. Cricket or saddle coverings shall be sheet metal or of the same material as the roof covering.

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## **Wind resistance**

IBC 2009, Section 1504-Performance requirements

**1504.1 Wind resistance of roofs.** Roof decks and roof coverings shall be designed for wind loads in accordance with Chapter 16 and Sections 1504.2, 1504.3 and 1504.4.

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**Section 1603****CONSTRUCTION DOCUMENTS**

**1603.1 General.** *Construction documents* shall show the size, section and relative locations of structural members with floor levels, column centers and offsets dimensioned. The design loads and other information pertinent to the structural design required by Sections 1603.1.1 through 1603.1.9 shall be indicated on the *construction documents*.

[continued...]

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**1603.1.4 Wind design data.** The following information related to wind loads shall be shown, regardless of whether wind loads govern the design of the lateral force resisting system of the structure:

1. Basic wind speed (3-second gust), miles per hour (km/hr.)
2. Wind importance factor, *I*, and *occupancy category*.
3. Wind exposure. Where more than one wind exposure is utilized, the wind exposure and applicable wind direction shall be indicated.
4. The applicable internal pressure coefficient.
5. Components and cladding. The design wind pressures in terms of psf (kN/m<sup>2</sup>) to be used for the design of exterior component and cladding materials not specifically designed by the *registered design professional*.

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## Wind resistance

IBC 2009, Section 1504.3-Wind resistance of nonballasted roofs

**1504.3 Wind resistance of nonballasted roofs.** Roof coverings installed on roofs in accordance with Section 1507 that are mechanically attached or adhered to the roof deck shall be designed to resist the design wind load pressures for components and cladding in accordance with Section 1609.

**1504.3.1 Other roof systems.** Roof systems with built-up, modified bitumen, fully adhered or mechanically attached single-ply, through fastened metal panel roof systems, and other types of membrane roof coverings shall also be tested in accordance with FM 4474, UL 580 or UL 1897.

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## Wind resistance

IBC 2009, Section 1504.3.2-Metal Panel Roof Systems

**1504.3.2 Metal panel roof systems.** Metal panel roof systems through fastened or standing seam shall be tested in accordance with UL 580 or ASTM E 1592.

**Exception:** Metal roofs constructed of cold-formed steel, where the roof deck acts as the roof covering and provides both weather protection and support for structural loads, shall be permitted to be designed and tested in accordance with the applicable referenced structural design standard in Section 2209.1.

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## **Wind resistance**

IBC 2009, Section 1504.4-Edge securement for low-slope roofs

**1504.5 Edge securement for low-slope roofs.** Low-slope membrane roof system metal edge securement, except gutters, shall be designed and installed for wind loads in accordance with Chapter 16 and tested for resistance in accordance with ANSI/SPRI ES-1, except the basic wind speed shall be determined from Figure 1609.

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## **Fire resistance**

IBC 2009, Section 1505-Fire Classification

**1505.1 General.** Roof assemblies shall be divided into the classes defined below. Class A, B and C roof assemblies and roof coverings required to be listed by this section shall be tested in accordance with ASTM E 108 or UL 790. In addition, fire-retardant-treated wood roof coverings shall be tested in accordance with ASTM D 2898. The minimum roof coverings installed on buildings shall comply with Table 1505.1 based on the type of construction of the building.

**Exception:** Skylights and sloped glazing that comply with Chapter 24 or Section 2610.

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## **Fire resistance**

IBC 2009, Section 1505-Fire Classification

**TABLE 1505.1<sup>a,b</sup>  
MINIMUM ROOF COVERING CLASSIFICATION  
FOR TYPES OF CONSTRUCTION**

IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
B	B	B	C <sup>c</sup>	B	C <sup>c</sup>	B	B	C <sup>c</sup>

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m<sup>2</sup>.

- a. Unless otherwise required in accordance with the *International Wildland-Urban Interface Code* or due to the location of the building within a fire district in accordance with Appendix D.
- b. Nonclassified roof coverings shall be permitted on buildings of Group R-3 and Group U occupancies, where there is a minimum fire-separation distance of 6 feet measured from the leading edge of the roof.
- c. Buildings that are not more than two stories in height and having not more than 6,000 square feet of projected roof area and where there is a minimum 10-foot fire-separation distance from the leading edge of the roof to a lot line on all sides of the building, except for street fronts or public ways, shall be permitted to have roofs of No. 1 cedar or redwood shakes and No. 1 shingles.

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## **Fire resistance**

IBC 2009, Section 1505-Fire Classification

**1505.2 Class A roof assemblies.** Class A roof assemblies are those that are effective against severe fire test exposure. Class A roof assemblies and roof coverings shall be listed and identified as Class A by an approved testing agency. Class A roof assemblies shall be permitted for use in buildings or structures of all types of construction.

**Exceptions:**

1. Class A roof assemblies include those with coverings of brick, masonry or an exposed concrete roof deck.
2. Class A roof assemblies also include ferrous or copper shingles or sheets, metal sheets and shingles, clay or concrete roof tile or slate installed on noncombustible decks or ferrous, copper or metal sheets installed without a roof deck on noncombustible framing.

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## **Vegetative roof systems**

IBC 2009, Section 1507.16-Roof gardens and landscaped roofs

**1507.16 Roof gardens and landscaped roofs.** Roof gardens and landscaped roofs shall comply with the requirements of this chapter and Sections 1607.11.2.2 and 1607.11.3

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## Reroofing

IBC 2009, Section 1510-Reroofing

**1510.3 Recovering versus replacement.** New roof coverings shall not be installed without first removing all existing layers of roof coverings down to the roof deck where any of the following conditions occur:

1. Where the existing roof or roof covering is water soaked or has deteriorated to the point that the existing roof or roof covering is not adequate as a base for additional roofing.
2. Where the existing roof covering is wood shake, slate, clay, cement or asbestos-cement tile.
3. Where the existing roof has two or more applications of any type of roof covering.

**Exceptions:...**

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IBC 2009, Section 1510-Reroofing

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**Exceptions:...**

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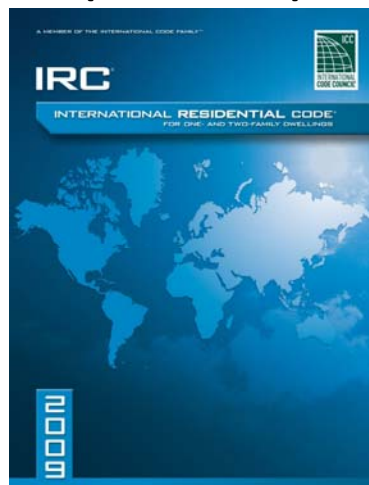
## Summary – IBC 2009

- Secondary drainage
- Crickets
- Wind design
  - Include loads in construction documents
- Fire resistance
- Vegetative roofs
- Reroofing

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## ***International Residential Code, 2009 Edition (IECC 2009)***



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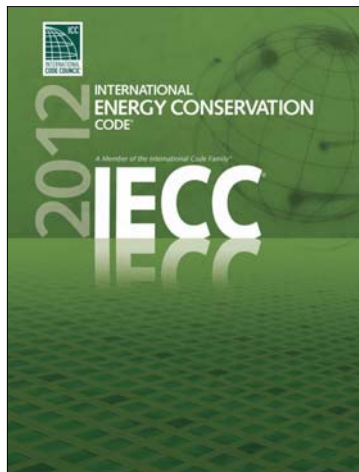
**International Residential Code, 2009 Edition**

- Chapter 9-Roof Assemblies
- Similar to IBC 2009, Chapter 15
- Required fire classification by local ordinance
- More prescriptive-based language

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**International Energy Conservation Code,  
2012 Edition (IECC 2012)**



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## Format of IECC 2012

### IECC – Commercial

Ch. 1[CE]: Scope and Admin.

Ch. 2[CE]: Definitions

Ch. 3[CE]: General Req.

Ch. 4[CE]: Commercial Energy  
Efficiency

Ch. 5[CE]: Referenced Stds.

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### IECC – Residential

Ch. 1[RE]: Scope and Admin.

Ch. 2[RE]: Definitions

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Ch. 4[RE]: Residential Energy  
Efficiency

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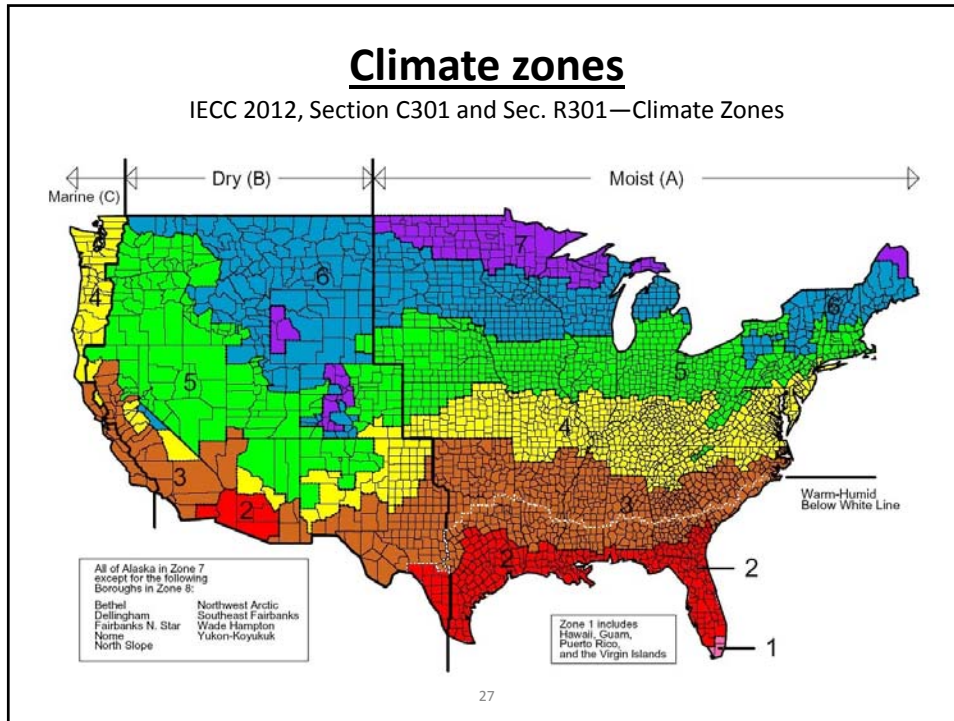
## Commercial vs. Residential

- Commercial unless Residential
- R202-General Definitions:

**Residential Building.** For this code, includes detached one- and two-family dwellings and multiple single-family dwellings (townhouses) as well as Group R-2, R-3 and R-4 buildings three stories or less in height above grade plane


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## IECC – Residential Provisions

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## **Roofing-specific adaptation of Table R402.1.1**

*International Energy Conservation Code, 2012 Edition*

<b>Climate zone</b>	<b>Ceiling R-value</b>
1	30
2	38
3	
4	49
5	
6	
7	
8	

<sup>a</sup> R-values are minimums. ...  
[Other footnotes omitted for clarity]

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## **IECC – Commercial Provisions**

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## Roofing-specific adaptation of Table C402.2

*International Energy Conservation Code, 2012 Edition*

Opaque Thermal Envelope Assembly Requirements			
Climate zone	Roof assembly configuration		
	Insulation entirely above deck	Metal buildings (with R-5 thermal blocks)	Attic and other
1	R-20ci	R-19 + R-11 LS	R-38
2			
3			
4	R-25 ci	R-25 + R-11 LS	R-49
5			
6	R-30ci	R-25 + R-11 LS	R-49
7	R-35ci	R-30 + R-11 LS	
8			

ci = Continuous insulation  
 LS = Liner system (a continuous membrane installed below the purlins and uninterrupted by framing members; uncompressed, faced insulation rests on top of the membrane between the purlins)

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## R-value determination

IECC 2012, Section C303.1.4-Insulation Product Rating

**C303.14 Insulation product rating.** The thermal resistance (R-value) of insulation shall be determined in accordance with the U.S. Federal Trade commission R-value rule (CFR Title 16, Part 460) in units of  $h \times ft^2 \times ^\circ F/Btu$  at a mean temperature of 75°F (24°C).

What about tapered insulation?

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## **Tapered insulation**

*International Energy Conservation Code, 2012 Edition*

**C402.2.1 Roof assembly.** The minimum thermal resistance (R-value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table C402.2, based on construction materials used in the roof assembly. Skylight curbs shall be insulated to the level of roofs with insulation entirely above deck or R-5, whichever is less.

**Exceptions:**

1. Continuously insulated roof assemblies where the thickness of insulation varies 1 inch (25 mm) or less and where the area-weighted U-factor is equivalent to the same assembly with the R-value specified in Table C402.2.

2. ...

IECC Commentary indicates Exception 1 applies to tapered insulation systems.

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## **2012 IECC Code and Commentary**

Tapered insulation

“...The exception to this section permits a roof that is “continuously insulated” to have areas that do not meet the required R-values, provided that the area-weighted values are equivalent to the specified insulation values. This type of insulation referred to as tapered insulation is where the roof insulation varies to provide slope for drainage...”

[continued...]

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## **2012 IECC Code and Commentary**

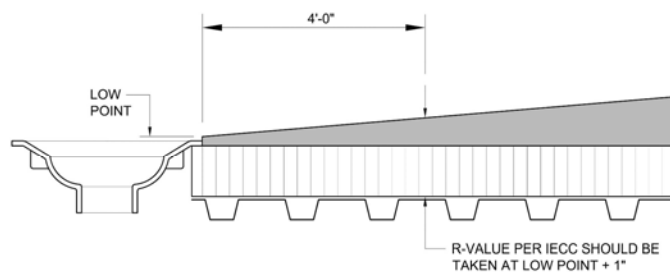
Tapered insulation

“...This 1-inch (25 mm) limitation does not prevent the provisions from being applied to roofs that have a greater variation; it simply does not allow the additional thickness to be factored into the average insulation values. Where the variation exceeds 1 inch (25 mm), it would be permissible to go to the thinnest spot and measure the *R*-value at that point (for the example call this Point “a”). Then go to a point that is 1 inch (25 mm) thicker than Point “a” and measure the *R*-value there (for the example, call this Point “b”). The remaining portions of the roof that are thicker than the additional 1-inch (25 mm) portion (Point “b”) would simply be assumed to have the same *R*-value that Point “b” had. All portions of the roof that meet or exceed the Point “b” *R*-value would simply use the Point “b” *R*-value when determining the area weighted *U*-factor for the roof. “

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## **Graphically depicted...**



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### **Summary – IECC 2012 – Commercial Provisions**

- R-value increases
- Mandatory reflectivity requirements in Climate Zones 1-3
- Air barriers requirements in Climate Zones 4-8

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### **So....**

- Do increased R-values make sense?
- Is there a realistic payback?

...we've done some calculations

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### In a cooling climate

10,000 sq. ft. single-story building in Miami, FL

R-value increase	Annual Btu savings	Payback time
R-10 to R-15	14,094,020 Btu	10.8 years
R-15 to R-20	7,870,571 Btu	21.9 years
R-20 to R-25	4,561,644 Btu	35.4 years
R-25 to R-30	3,232,756 Btu	76.7 years

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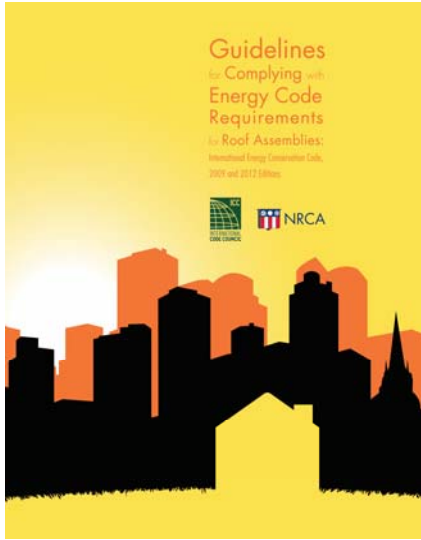
### In a heating climate

10,000 sq. ft. single-story building in Boston, MA

R-value increase	Annual Btu savings	Payback time
R-10 to R-15	49,647,013 Btu	6.7 years
R-15 to R-20	27,375,148 Btu	13.8 years
R-20 to R-25	15,748,557 Btu	22.3 years
R-25 to R-30	11,098,322 Btu	48.4 years

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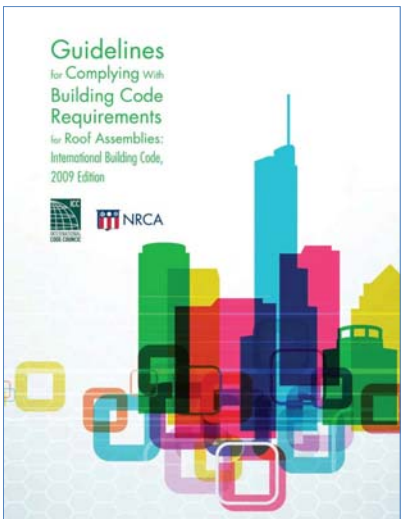
**Guidelines for Complying with Energy Code Requirements for Roof Assemblies: International Energy Conservation Code, 2009 and 2012 Editions**

Contact NRCA Customer Service:  
1-888-ASK-NRCA (275-6722)  
or [shop.nrca.net](http://shop.nrca.net)

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## **Building Codes Manual (2009 Codes)**

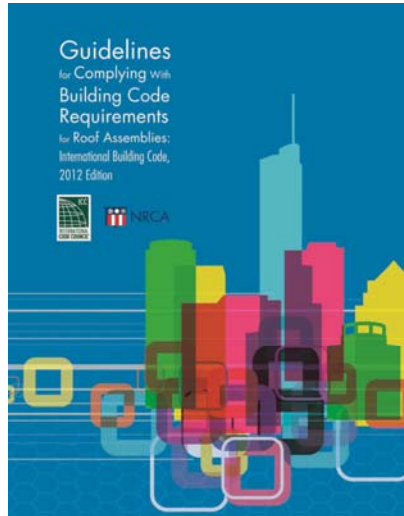


- Based on 2009 I-codes:
  - IBC 2009
  - IRC 2009
  - IECC 2009
  - IPC 2009
  - IFC 2009
- Includes roofing-related code text and NRCA commentary on each section
- Co-branded with ICC; NRCA promotes to industry and ICC promotes to code officials

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## **Building Codes Manual (2012 Codes)**



- Based on 2012 I-codes:
  - IBC 2012
  - IRC 2012
  - IECC 2012
  - IPC 2012
  - IFC 2012
- Includes roofing-related code text and NRCA commentary on each section
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