Know Your Code Requirements

DONALD R. SCOTT, SE, FSEI, FASCE
PSC STRUCTURAL SOLUTIONS
Pacific Plaza, 1250 Pacific Ave., Suite 701, Tacoma, WA, 98402
Phone: 206-292-5076 • E-mail: dscott@pcs-structural.com

AND

WANDA D. EDWARDS, PE
RCI, INC.
1500 Sunday Dr., Ste. 204, Raleigh, NC 27607
Phone: 919-812-0856 • E-mail: wedwards@rci-online.org
Abstract

The codes are becoming more and more complex. Designers are challenged to keep abreast of current code provisions. The 2015 International Codes have been available for several years, the 2018 International Codes will be published in January 2018, and work has begun on the 2021 edition of the International Codes. This presentation will cover major changes that will affect your projects, possible changes to the 2021 edition, and code requirements you may not be familiar with. Among the topics covered will be secondary drainage requirements for reroofs, susceptible bay requirements, ponding analysis requirements, and interpretations from the commentaries published by the International Code Council. The presentation will focus on the International Building Codes, International Existing Building Code, and the International Energy Conservation Codes.

Speakers

Donald R. Scott, PE, SE, FSEI, FASCE — PSC Structural Solutions

DON SCOTT is a member of multiple national engineering boards, has been a member of ASCE 7 Wind Load Subcommittee for over 20 years, and is a member of several other ASCE 7 committees. He was the chairman of the ASCE 7 Wind Load Subcommittee for the 2016 edition and is continuing as chairman for the 2022 edition, which sets the standards for wind loads on buildings. Scott is a past president of the board for the Applied Technology Council. He has authored many technical publications, given numerous industry presentations on wind design loads for ASCE/SEI, and has given several National Council of Structural Engineers Association webinars on the same subject.

Wanda Edwards, PE — RCI, Inc.

WANDA EDWARDS is the Senior Director of Technical Services for RCI. Before joining RCI, Edwards served as director of code development for the Institute for Business and Home Safety (IBHS). Previously, Edwards served as deputy commissioner and chief engineer for the Engineering Division of the North Carolina Department of Insurance, and her responsibilities included administration and regulation of the building codes. She was a Fulbright scholar to Trinidad and Tobago and previously owned a design/construction/development firm. Edwards earned her bachelor’s degrees in civil engineering and architecture from North Carolina State University. She is a licensed professional engineer and serves on various committees within ASTM, ICC, and NIBS.
Jurisdictions around the country have or are beginning to adopt the 2015 International Codes, while the 2018 editions of the codes are complete, and work has begun on the 2021 versions of the International Codes. This paper will highlight changes in the 2015 and 2018 codes and forecast where we’re headed in the 2021 codes. (Text that is underlined is the new code language.)

2015 INTERNATIONAL BUILDING CODE (IBC)
CHAPTER 14

The first significant change to the building envelope requirements of the 2015 IBC (Figure 1) is in Chapter 14, Exterior Walls, Section 1405.3, Vapor Retarders (Figure 2). This has been revised to state where vapor retarders are not allowed to be installed in certain climate zones. The change will help to prevent the migration of moisture from the exterior into the wall and condensing on the cooler side of the interior wall. The code provision is not limiting the use of various types of vapor retarders; it is simply stating where they cannot be installed.

1405.3 Vapor Retarders

1405.3 Vapor Retarders. Vapor retarders as described in Section 1405.3.3 shall be provided in accordance with Sections 1405.3.1 and 1405.3.2, or an approved design using accepted engineering practice for hygrothermal analysis.

1405.3.1 Class I and II Vapor Retarders

Class I and II vapor retarders shall not be provided on the interior side of frame walls in Zones 1 and 2. Class I vapor retarders shall not be provided on the interior side of frame walls in Zones 3 and 4. Class I or II vapor retarders shall be provided on the interior side of frame walls in Zones 5, 6, 7, 8, and Marine 4. The appropriate zone shall be selected in accordance with Chapter 3 of the International Energy Conservation Code.

Exceptions:

1. Basement walls
2. Below-grade portion of any wall
3. Construction where moisture or its freezing will not damage the materials
4. Conditions where Class III vapor retarders are required in Section 1405.3.2

1405.3.2. Class III Vapor Retarders

Section 1405.3.2, Class III Vapor Retarders, is intended to avoid situations where both sides of the wall become a vapor retarder and moisture is trapped within the wall. For example, a wall with foam sheathing insulation on the exterior of the wall will result in the foam sheathing acting as a vapor retarder. If a Class I or Class II retarder is installed on the interior side of the wall, the moisture may be trapped between the vapor retarders. “Therefore, only Class III vapor retarders with a perm rating greater than 1 and no more than 10 are permitted on the interior side of the wall so that the moisture can escape back into the interior of the building.”

Figure 1 – Cover of 2015 IBC. Courtesy of the International Code Council.

Figure 2 – Vapor retarder locations.1
Class III vapor retarders shall be permitted where any one of the conditions in Table 1405.3.2 is met. Only Class III vapor retarders shall be used on the interior side of frame walls where foam plastic insulating sheathing with a perm rating of less than 1 is applied in accordance with Table 1405.3.2 on the exterior side of the frame wall.

1405.3.3 Material Vapor Retarder Class

Section 1405.3.3, Material Vapor Retarder Class, provides more information on the specific materials for each classification and the perm ratings for each class. The vapor retarder class shall be based on the manufacturer’s certified testing or a tested assembly. The following shall be deemed to meet the class specified:

- Class I: Sheet polyethylene, nonperforated aluminum foil with a perm rating of less than or equal to 0.1.
- Class II: Kraft-faced fiberglass batts or paint with a perm rating greater than 0.1 and less than or equal to 1.0.
- Class III: Latex or enameled paint with a perm rating of greater than 1.0 and less than or equal to 10.0.

CHAPTER 15

The most significant code change to the 2015 International Building Code impacting roof and building envelope consultants is a change to the general reroofing requirements in Chapter 15.

Section 1511 Reroof

1511.1 General.

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

Exceptions:

1. Roof replacement or roof re-cover of existing low-slope roof coverings 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. For the purposes of this exception, existing secondary drainage or scupper systems required in accordance with this code shall not be removed unless they are replaced by secondary drains or scuppers designed and installed in accordance with Section 1503.4.

Exception 2 was added to the 2015 edition of the IBC. The exception applies to roof covers and replacements and states that a secondary (emergency) overflow drainage system is not required on reroofing projects if one doesn’t exist prior to the reroof. Before 2015, the code required that reroofs must meet all the requirements of Chapter 15, which would include analyzing the roof drainage and providing adequate primary and secondary drainage.

Under the provisions of the 2015 IBC, Section 1511.1, there is no requirement to analyze the existing system or to provide a secondary drainage system—only to provide positive drainage. The code defines positive drainage as the drainage condition in which consideration has been made for all loading deflections of the roof deck, and additional slope has been provided to ensure drainage of the roof within 48 hours of precipitation. The code does not state what constitutes “consideration,” nor who is to provide the consideration, nor what loads are to be considered.

As often happens with code changes, provisions that appear in multiple codes often get overlooked. The reroofing requirements of the IEBC and IBC are a good example of this. The code proposal to add Exception 2 in the IBC did not include a like change to the IEBC. Therefore, the IEBC, Section 706, Reroofing, does not match the IBC Section 1511, Reroofing. Section 706.1 reads as follows:

Section 706 Reroof

706.1 General.

Materials and methods of application used for recovering or replacing an existing roof covering shall comply with the requirements of Chapter 15 of the International Building Code.

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 of the International Building Code for roofs that provide positive roof drainage.

Section 706.1 begins the same as Section 1511.1. As you can see, there is only one exception to Section 706.1. Exception #2 in the IBC Section 1511.1 is not included in the IEBC. Because Exception #2 is not in the Section 706.1, it appears that if one is designing projects utilizing the IEBC, secondary drainage would be required on projects. RCI recommends that secondary drainage be installed if none exists on reroofing projects. A technical advisory can be found on RCI’s website at www.rci-online.org.

CHAPTER 16

Chapter 16, Structural Design, includes several structural changes that will impact the building envelope. First, Section 1603, Construction Documents, has been revised to require additional information on the design drawings.

1603.1.3 Roof Snow Load Data

The ground snow load, Pgs, shall be indicated. (See Figure 3) In areas where the ground snow load exceeds 10 pounds per square foot (psf) (0.479 kN/m²), the following additional information shall also be provided, regardless of whether snow loads govern the design of the roof:

1. Flat-roof snow load, Pf
2. Snow exposure factor, Ce
3. Snow load importance factor, l
4. Thermal factor, Ct
5. Drift surcharge loads, pd, where the sum of pd and Pf exceeds 20 psf (0.96 kN/m²)
6. Width of snow drift(s), w

1603.13 Photovoltaic Panel Systems

1603.18.1 Photovoltaic Panel Systems. The dead load of roof top mounted photovoltaic panel systems, including rack support systems, shall be indicated on the construction documents.

1607.9 Impact Loads for Façade Access Equipment

The IBC has added two new sections to Section 1607, Impact Loads for
Because lifeline anchorages are required in case there is a problem with the primary suspension system, the effective factor of safety of two (from a design load of 2540 pounds to an ultimate load of 5000 pounds) is deemed necessary to provide an acceptable level of safety. To address these safety issues, these loading requirements have been added to Section 1607.9.

**1607.9.3 Elements Supporting Hoists for Façade Access Equipment**

In addition to any other applicable live loads, structural elements that support hoists for façade access equipment shall be designed for a live load consisting of the larger of the rated load of the hoist times 2.5 and the stall load of the hoist.

**1607.9.4 Lifeline Anchorages for Façade Access Equipment**

In addition to any other applicable live loads, lifeline anchorages and structural elements that support lifeline anchorages shall be designed for a live load of at least 3100 pounds (13.8 kN) for each attached lifeline, in every direction that a fall arrest load may be applied.

**1607.12.3 Occupiable Roofs**

Areas of roofs that are occupiable, such as vegetative roofs, roof gardens, or for assembly or other similar purposes, and marquees are permitted to have their uniformly distributed live loads reduced in accordance with Section 1607.10.

**Vegetative and Landscaped Roofs**

A new definition, along with load requirements, has been added for vegetative roofs (Figure 4):

**Vegetative Roof.** An assembly of interacting components designed to waterproof and normally insulate a building’s top surface that includes, by design, vegetation and related landscape elements.

**1607.12.3.1 Vegetative and Landscaped Roofs.** The uniform design live load in unoccupied landscaped areas on roofs shall be 20 psf (0.958 kN/m²). The weight of all landscaping materials shall be considered as dead load and shall be computed on the basis of saturation of the soil as determined in accordance with ASTM E2397.
The uniform design live load in unoccupied landscaped areas on roofs shall be 20 psf (0.958 kN/m²). The uniform design live load for occupied landscaped areas on roofs shall be determined in accordance with Table 1607.1.

Section 1607 has also added new requirements for loads for photovoltaic (PV) panel systems and ballasted PV systems. Seismic requirements for ballasted PV systems have also been added to Section 1613.

**2018 INTERNATIONAL BUILDING CODE**

The most significant change in the 2018 edition of the IBC will be the shift to the 2016 edition of the American Society of Civil Engineers’ Standard 7 (ASCE 7-16), Minimum Design Loads and Associated Criteria for Buildings and Other Structures. This was published and became available in June of 2017. ASCE 7-16 will be referenced in the 2018 editions of the IBC and the IRC, and thus, it will become the requirement for determining design loads and load combinations for the design of buildings when adopted by authorities having jurisdiction.

Some of the wind load provisions in ASCE 7-16 have changed dramatically from those specified in previous editions of the IBC, IRC, and ASCE 7. The basic (design) wind speed maps were modified for the non-hurricane-prone region, with most of the basic wind speeds being reduced. This results in wind design pressures for buildings greater than 60 ft. high being somewhat less than or equal to the loads specified in earlier editions of the codes and standards for these buildings. The largest changes in the ASCE 7-16 have occurred regarding those buildings with a roof height less than or equal to 60 ft. The changes have affected both the magnitude of the loads on the roof and the configurations of the zones for application of these loads.

The changes contained within ASCE 7-16 include the new wind speed maps, a new ground elevation factor, removal of the truncated $K_z$ factor below the 30-ft. level, and changes in the roof pressure coefficients and the configurations of the roof loading. The standard includes new information on rooftop PV panels, rooftop equipment on buildings with a roof height greater than 60 ft., and new information in the Commentary regarding tornado wind loads.

**New Wind Speed Maps**

The basic (design) wind speed for the lower 48 states has been designated in two uniform sections outside of the hurricane-prone region.
since the 1995 edition of ASCE 7. These two regions were divided along state boundaries, with the western region including the states of California, Oregon, and Washington; and the second region encompassing the remaining states outside of the hurricane-prone region. The new wind speed maps contained in ASCE 7-16 account for the regional variations of wind speed across the country. See Figure 5.

Generally, the winds speeds in the northern Great Plains remain very similar in magnitude to the values contained in previous editions of the standard, and in the other areas of the country, the design values have decreased from 5 to 15 miles per hour, with the largest decrease in wind speeds occurring in the western portions of the country. The design wind speeds in the hurricane-prone region remain unchanged from Texas to the Carolinas and are slightly reduced in the northeast, from Maine to Virginia.

**The Ground Elevation Factor, Ke**

The new ground elevation factor, Ke, is an adjustment for air density. A discussion of the effects of elevation on the density of air has been included in the commentary of previous editions of the standard. With the 2016 edition, this factor was brought forward to the body of the provisions. The higher the ground elevation is at a building site, the less dense the air. With reduced density, a given wind speed exerts less wind pressure. For the coastal areas of the country, this factor has little or no effect on the wind loading on the building; however, for locations like Denver, the effect can be a 20% reduction in the wind loads. See Figure 6.

### Ground Elevation Factors

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**Low-slope Roof Pressure Zoning**

In previous editions of ASCE 7, the roof zone configurations and dimensions were a function of the least horizontal dimension of the building and the roof height. In ASCE 7-16, the zone dimensions for low-slope (<70) are based only on the roof height. This correlation was determined from a review of studies available in the NIST database. Also, a new zone, “one prime” (1’) has been added to the roof zoning for larger-plan buildings at the interior of the building. The result of these changes is that the higher-pressure wind zones around the perimeter of the building roof are much larger than previously indicated. See Figure 7.

**CONCLUSIONS**

In considering all of the wind provision changes in ASCE 7-16, the following conclusions may be reached:

- The roof design wind pressures in the hurricane-prone regions of the country have increased.
• With the inclusion of the elevation factor and the reduced design wind speeds for the remaining portions of the country, in many cases, the roof design wind pressures remain consistent or are lower as compared to previous editions of the ASCE 7.

• The largest percentage changes in the roof design wind pressures occur in the center zones of the roof in comparison to the changes at the perimeter zones.

FUTURE ISSUES

During the last round of code hearings, there were numerous proposals to include specific commissioning provisions for various parts of the codes. These proposals will probably be reintroduced during the next code cycle.

The 2018 International Existing Building Code was revised to include Exception #2 in Section 703.6. RCI will work to have the Exception #2 to Section 1511.1 and Section 703.6 deleted from the IBC and the IEBC. Work has begun to review and compare the 2018 IBC and IEBC and develop proposals to provide better consistency between the IBC and the IEBC.

There is a movement in the code arena to include outcome-based designs. A proposal was introduced during the last code cycle to set requirements for outcome of energy consumption without prescriptive solutions. This proposal is likely to be reintroduced. Performance-based design requirements are becoming popular and will likely be reintroduced.

Future issues at code hearings will include where ballasted roofs can be installed and how ballasted PVs are to be installed. NIST introduced a proposal in the last round of hearings to include a tornado map and to prohibit aggregate-surfaced roofs on Risk Category III and IV buildings in the area of the country that has a design wind speed of 250 mph for tornado shelters. Also expect a proposal to allow ballasted roofs with parapets to prevent blow-off, based upon the height of the parapet and the wind speed maps.

Look for all these issues to reappear for inclusion in the 2021 codes.

ENDNOTES


2. Ibid.