



Changes to the Wind Speed Maps and Wind Design – 2010 Florida Building Codes¹

SCOPE AND ASCE 7

The determination of wind loads on buildings has changed little since the inception of the *Florida Building Code*. However, the 2010 edition of the *Florida Building Code* introduces significant changes to wind load design, in particular the presentation of the wind speed maps. The key changes will be further discussed and are summarized as follows:

- New strength design-level wind speed maps
- Changes to the Wind-borne Debris Region
- Introduction of Exposure Category D for water surfaces in Hurricane-Prone Regions

The scoping section (Section 1609.1.1) for the determination of wind loads in *Florida Building Code, Building* (FBCB) states that wind loads on every building or structure is required to be determined in accordance with Chapters 26 through 30 of ASCE 7. This reference is to the 2010 Edition of ASCE 7 (ASCE 7-10). The changes to the wind loading criteria in the *Florida Building Code* are due almost exclusively to the changes to the wind provisions in ASCE 7-10.



While ASCE 7-10 provides the methodology for determining design wind pressures and forces, the design wind speeds, Exposure Categories and requirements for wind-borne debris protection are to be as specified in the Florida Building Code, Building and Florida Building Code, Residential (FBCR) as applicable.

Section 1609.1.1 of the 2010 FBCB still maintains a list of exceptions to complying with ASCE 7 for the determination of wind loads. Many of the exceptions are for the prescriptive “high wind” standards developed for residential buildings. In the 2010 FBCB and FBCR, two new prescriptive standards are permitted to be used in lieu of designing in accordance with ASCE 7. ICC 600 replaces the *IBHS Guidelines* and provides prescriptive wind resistant design methodologies for wood-frame, concrete, steel and concrete masonry residential buildings. AISI S230 has been added for steel framed residential buildings. The 2010 FBCB permits the use of the Alternate All-Heights method provided in Section 1609.6 and discussed at the end of this document.

Wind Speed Maps - 2010 FBCB

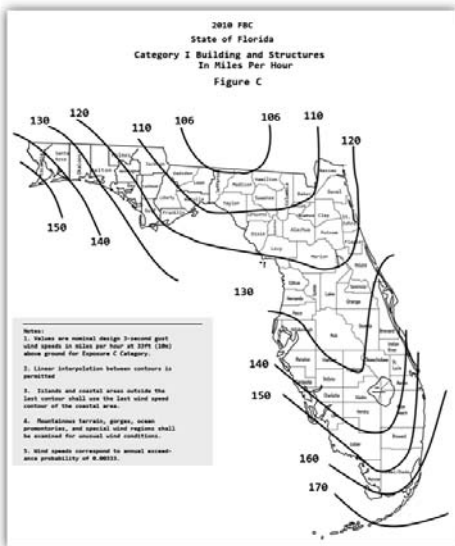
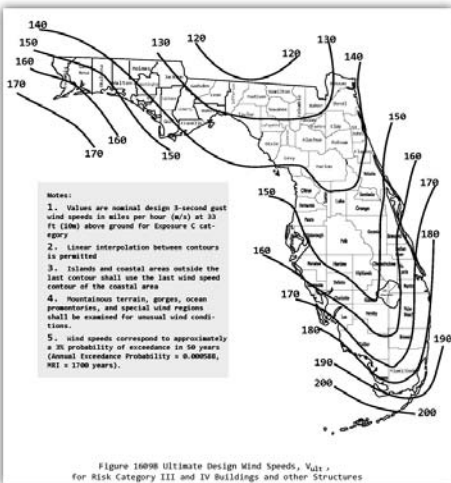
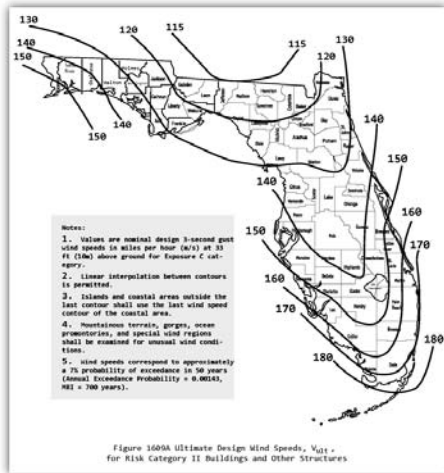
The wind speed maps in the 2010 FBCB have been revised significantly from the 2007 Florida Building Code. The primary changes are as follows:

- Strength design-level (Ultimate) wind speeds replace the ASD-level wind speeds in the 2007 Florida Building Code.
- Wind speed maps are provided for each Risk Category (formerly Occupancy Categories) instead of applying an Importance Factor to the design pressure calculations for Risk Categories III and IV. The Importance Factor for wind loads has been deleted from ASCE 7-10.

The term “Risk Category” replaces the term “Occupancy Category”. For a full description of each Risk Category, refer to Table 1604.5 in the 2010 FBCB.

¹DISCLAIMER – This piece is intended to give the reader only general factual information current at the time of publication. This piece is **not** a substitute for professional advice and should not be used for guidance or decisions related to a specific design or construction project. This piece is not intended to reflect the opinion of any of the entities, agencies or organizations identified in the materials and, if any opinions appear, are those of the individual author and should not be relied upon in any event. Applicable to the 2010 Florida Building Code.

See Figures 1609A, 1609B, and 1609C below:



It is important to note the wind speed maps in the 2010 FBCB are strength design level wind speeds. While not specifically stated, the wind speed maps in the 2007

FBCB and prior editions are ASD-level or nominal wind speeds. For strength design (Load and Resistance Factor Design), the load factor on wind is now 1.0. In the 2007 FBCB and prior editions, the load factor on wind for strength design is 1.6. For example, Equation 16-6 which specifies one of the load combinations required for strength design including dead, wind and lateral earth pressure loads is as follows:

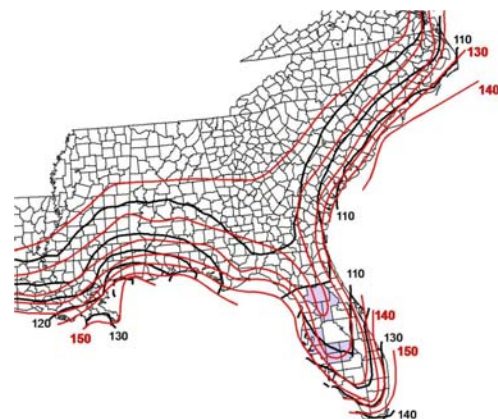
$$0.9D + 1.0W + 1.6H \quad (\text{Equation 16-6})$$

While the map values are much higher for most of the state, to appropriately compare the new map values with the 2007 wind speed maps, the new map values have to be converted to an ASD form. This can be accomplished by using Equation 16-32 in the FBCB.

$$V_{asd} = V_{ult} \sqrt{0.6} \quad (\text{Equation 16-32})$$

where V_{asd} represents the equivalent nominal or ASD-level wind speed and V_{ult} is the design wind speed from Figures 1609A, 1609B, and 1609C. The terms “ultimate design wind speed” and “nominal design wind speed” are not used in ASCE 7-10 but were incorporated in the 2010 FBCB due to the significant number of provisions and “triggers” tied to the 2007 FBCB wind speeds. This specifically draws the user’s attention to the different types of wind speeds – similar to what was done with the change from the fastest-mile to 3-sec. gust wind speeds in the first editions of the *Florida Building Code*.

The following figure shows a comparison of the 2010 FBCB wind speed map values for Risk Category II buildings with the 2007 FBCB wind speed map values. To make this comparison, the 2010 FBCB wind speed map values were converted to ASD-level wind speeds by multiplying the values by $\sqrt{0.6}$ and redrawing the contours to align on whole numbers. The black contours represent the 2010 FBCB Risk Category II wind speed map values converted to ASD-level values, and the red contours represent the 2007 FBCB wind speed map values.



As shown, the equivalent wind speeds for the 2010 FBCB have actually decreased for most of the state when compared to the 2007 FBCB wind speeds. This is due to new data and better modeling techniques and represents the best scientific knowledge available.

For the specific location of a wind speed contour for a particular location, consult the local authority having jurisdiction as applicable.

High-Velocity Hurricane Zones

The High-Velocity Hurricane Zones (HVHZ) are specifically defined as Miami-Dade and Broward Counties. As in previous editions of the FBCB, a single wind speed is used for the HVHZ for each Risk Category Map. The design wind speeds in the HVHZ are as follows:

Miami-Dade County

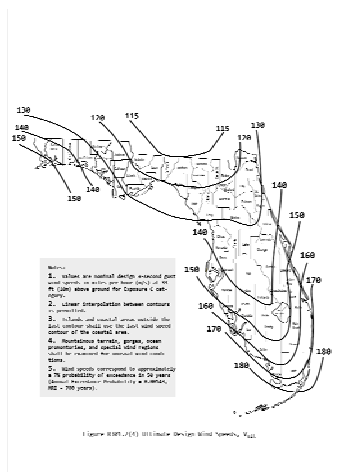
- Risk Category I Buildings and Structures: 165 mph
- Risk Category II Buildings and Structures: 175 mph
- Risk Category III and IV Buildings & Structures: 185 mph

Broward County

- Risk Category I Buildings and Structures: 156 mph
- Risk Category II Buildings and Structures: 170 mph
- Risk Category III and IV Buildings & Structures: 180 mph

Wind Speed Maps - 2010 FBCR

The wind speed map in the 2010 FBCR is in essence the wind speed map for Risk Category II (Figure 1609A) buildings and structures in the 2010 FBCB. Since the FBCR only applies to Risk Category II buildings (one- and two-family dwellings and townhouses not more than 3 stories in height), there is no need for additional maps. All of the information previously discussed regarding the maps in the 2010 FBCB applies equally to the wind speed map in the 2010 FBCR.



In the HVHZ, the 2010 FBCR specifies a wind speed of 175 mph in Miami-Dade County and 170 mph in Broward County.

Load Combinations

The changes to the load combinations highlight how the design pressures calculated from the new wind speed maps relate to the design pressures using the wind speed maps in the 2007 FBCB.

For strength design (or load and resistance factor design), the load factor on the wind load (W) has been changed to 1.0 reflecting the fact that the wind speed values are to be used directly with the strength design methodology. The maps in the 2007 FBCB were to be used directly with allowable stress design; hence the strength design methodology previously requiring the use of a 1.6 load factor on W. A few excerpts from the strength design load combinations in the 2010 FBCB are as follows:

$$1.2D + 1.0W + f_1L + 0.5(L_r \text{ or } R) \quad (\text{Equation 16-4})$$

$$0.9D + 1.0W + 1.6H \quad (\text{Equation 16-6})$$

For allowable stress design, design wind loads have to be factored down to an allowable stress design level because the wind speed maps are to be used directly with strength design. This is accomplished by multiplying the wind load (W) by 0.6. A few excerpts from the allowable stress design load combinations in the 2010 FBCB are as follows:

$$D + H + F + 0.6W \quad (\text{Equation 16-12})$$

$$0.6D + 0.6W + H \quad (\text{Equation 16-14})$$

Design pressure comparisons

To make appropriate comparisons of the design pressures calculated from ASCE 7-10 to those calculated from ASCE 7-05, the ASCE 7-10 design pressures have to be adjusted. This adjustment is accomplished by multiplying the ASCE 7-10 design pressures by 0.6, as specified in the allowable stress design load combinations, which will present the design pressures in a form consistent with allowable stress design. The following table uses this approach to show the differences in design pressures for Risk Category II buildings for select cities in the State of Florida. The ASCE 7-10/2010 FBCB wind speed column represents estimated wind speeds for the sites selected. The wind speeds for the county-specific maps may vary somewhat. In the percent differences column, the percentage differences represent how the design pressures calculated from ASCE 7-10 and the 2010 FBCB compare to ASCE 7-05 and the 2007 FBCB.

Comparison of Design Pressures for Risk Category II Buildings

City	V ASCE 7- 05/2007 FBCB	V ASCE 7- 10/2010 FBCB (est.)	Percent Difference in Comparable Design Pressures	
			Exp B Inland	Exp D ^{2,3,4} Coastal
Pensacola	140	155	-27%	-12%
Tampa	123	145	-17%	0%
Orlando	110	135	-10%	NA
Miami- Dade ¹	146	175	-14% ¹	+3%
Broward ¹	140	170	-12% ¹	+6%
Tallahassee	110	118	-31%	NA
Gainesville	100	125	-7%	NA
Jacksonville	120	125	-35%	-22%

Notes:

1. Miami-Dade and Broward Counties require all buildings to be considered to be in Exposure Category C.
2. ASCE 7-10 and proposed 2010 FBC requires all water surfaces, including hurricane prone regions, to be considered Surface Roughness D.
3. 2007 FBC requires roof-to-wall uplift and roof sheathing uplift loads to be increased by 20% for buildings located within 600 ft of inland bodies of water that represent a fetch of 1 mile or more.
4. The Exposure D analysis would also apply to inland bodies of water meeting the definition of Exposure Category D.

Wind-borne Debris Regions (WBDR)

The WBDR have historically been tied to a specific wind speed. The implementation of the new wind speed maps necessitates a recalibration of the WBDR triggers. In the 2010 FBCB and 2010 FBCR the new WBDR are defined as follows:

Areas located:

1. Within 1 mile (1.61 km) of the coastal mean high water line where the ultimate design wind speed, V_{ult} is **130 mph** (48 m/s) or greater; or
2. In areas where the ultimate design wind speed, V_{ult} is **140 mph** (53 m/s) or greater.

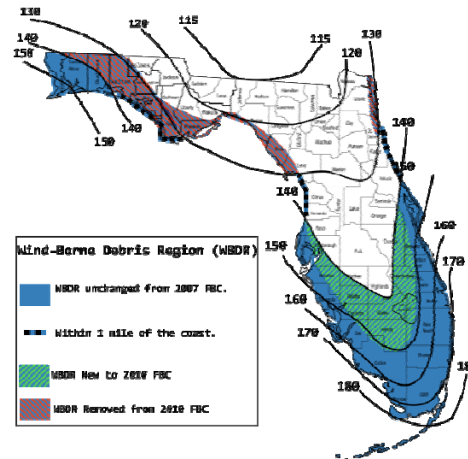
Additionally, the code adds a small wrinkle to the applicability of the maps to each Risk Category.

For Risk Category II buildings and structures, and Risk Category III buildings and structures, except health care facilities, the WBDR is to be determined using Figure 1609A (Risk Category II map).

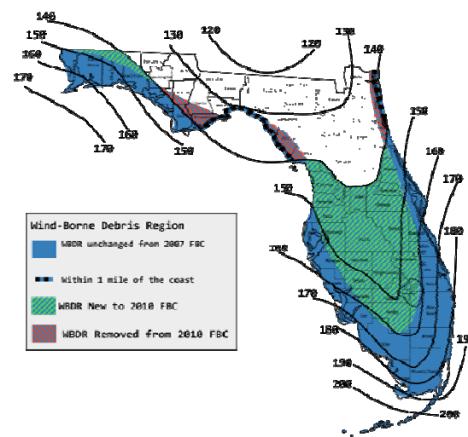
For Risk Category III health care facilities and all Risk Category IV buildings and structures, the WBDR is to be determined using Figure 1609B (Risk Category III and IV map).

So, for Risk Category III buildings excluding healthcare facilities, design wind speeds are required to be determined in accordance with Figure 1609B (Risk Category III and IV map), but the WBDR for such a structure is to be determined in accordance with Figure 1609 A (Risk Category II map).

The following maps show how the WBDR in the 2010 FBCB and 2010 FBCR has changed from the 2007 editions:



Changes to the WBDR for Risk Category II and III buildings and structures except health care facilities. Includes buildings scoped by the FBC.



Changes to the WBDR for Risk Category IV buildings and structures and category III healthcare facilities.

It is also worth noting the 2010 FBCR requires an additional area of a building to be protected from impact in WBDR. The 2007 FBCB and FBCR only require glazed openings (HVHZ requires the whole building envelope to be impact resistant) to be protected from impact due to wind-borne debris. The 2010 FBCR requires ventilation openings in an exterior wall into an

attic space in buildings located in WBDR have opening protection meeting the requirements of AMCA 540 or protected with an impact-resistant covering complying with ASTM E 1996 or other approved standards.

Exposure Category D

Since the first edition of the *Florida Building Code*, including ASCE 7-98, ASCE 7-02, and ASCE 7-05, in hurricane-prone regions, sites exposed to open water have been classified as Exposure Category C. This was based on research that, at the time, indicated the sea surface roughness in hurricanes increased as wind speed increased. Newer research has shown this not to be the case. The newer studies show the sea surface drag reaches a maximum when wind speeds are between 60 to 80 mph. Additionally, there was some evidence indicating the sea surface drag actually decreases as wind speed increases. In recognition of this research, the use of Surface Roughness D is now required for all water surfaces in hurricane-prone regions including coastal areas. Exposure D will apply where Surface Roughness D prevails in the upwind direction for at least 5000 ft (1524 m) or 20 times the height of the building whichever is greater. More simply put, Exposure D applies where the building or structure is exposed to wind over open water that extends 5000 ft or 20 times the height of the building in the upwind direction.

Alternate All-Heights Method

The 2010 FBCB does contain an alternative design method to designing strictly in accordance with ASCE 7-10. This method is contained in Section 1609.6 of the FBCB and requires the use of ASCE 7-10 for certain parts. It is not really a simplification, but is more of a different framework to use the equations and coefficients in ASCE 7-10. The method takes advantage of certain known variables for specific buildings and combines pressure coefficients to what is referred to as “collapsed” C_{net} values, or net pressure coefficients. Torsional effects and other variables have to be determined in accordance with ASCE 7-10. Most users will not find this method particularly more useful than using ASCE 7-10.

Prescriptive Construction Provisions of the FBCR

The FBCR has historically contained prescriptive construction provisions for nonhurricane-prone regions that are derived from the base code (IRC) in addition to prescriptive provisions for hurricane-prone regions (developed by the Florida Building Commission). The provisions were distinguished according to the basic wind speed. For clarity and to prevent someone from inadvertently applying the prescriptive provisions for nonhurricane-prone regions in the State of Florida, these prescriptive provisions have been deleted from the 2010 FBCR. Only the prescriptive provisions that apply to

structures in hurricane-prone regions remain in the 2010 FBCR.

Resources

Florida Building Commission www.floridabuilding.org

International Code Council www.iccsafe.org

American Society of Civil Engineers www.asce.org

Insurance Institute for Business and Home Safety
www.ibhs.org

Miami-Dade County Building and Neighborhood Compliance Department, www.miamidade.gov/building

Significant Changes to the Wind Load Provisions of ASCE 7-10, T. Eric Stafford, www.asce.org

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