FEMA Fact Sheet

Highlights of Significant Changes to the Wind Load Provisions of ASCE 7-22

ASCE/SEI 7-22, *Minimum Design Loads and Associated Criteria for Buildings and Other Structures* (commonly referred to as ASCE 7-22), developed and published by the American Society of Civil Engineers (ASCE) and Structural Engineering Institute (SEI), will be the primary reference standard for structural loads in the 2024 *International Building Code, 2024 International Residential Code, and the 8th Edition (2023) Florida Building Code*. The standard specifies minimum structural design loads and other criteria for the design of buildings and other structures for dead, live, soil, flood, tsunami, snow, rain, atmospheric ice, earthquake, wind, and tornado loads. It also provides criteria on how to assess load combinations.

This overview highlights a few of the key significant changes to the wind loading design provisions contained in ASCE 7-22, as compared to the previous version (ASCE 7-16), that will affect building design. The topics in this overview include:

- Changes to the basic wind speed maps
- Change to the Wind-borne Debris Region (WBDR)
- Changes to the component and cladding external pressure coefficients (GC_p) for roofs of buildings with roof slopes greater than 7°

Changes to the Basic Wind Speed Maps

The basic wind speed maps in ASCE 7-22 have been revised primarily in hurricane-prone regions. These changes are the result of ongoing improvements to the hurricane simulation model that is used to develop the wind speeds in hurricane-prone regions. The changes also include better wind speed estimates in the areas where hurricane wind speeds transition to non-hurricane wind speeds adjacent to the hurricane-prone coast.

Summary of changes to basic wind speeds in hurricane-prone regions:

- Decreases along the North-Atlantic coast
- Minor adjustments in the Carolinas and Virginia
- Increases along the Florida panhandle and big bend areas
- Slight decreases along the coastal areas of Alabama, Mississippi, and Louisiana
- Increases along the coastal areas of Texas

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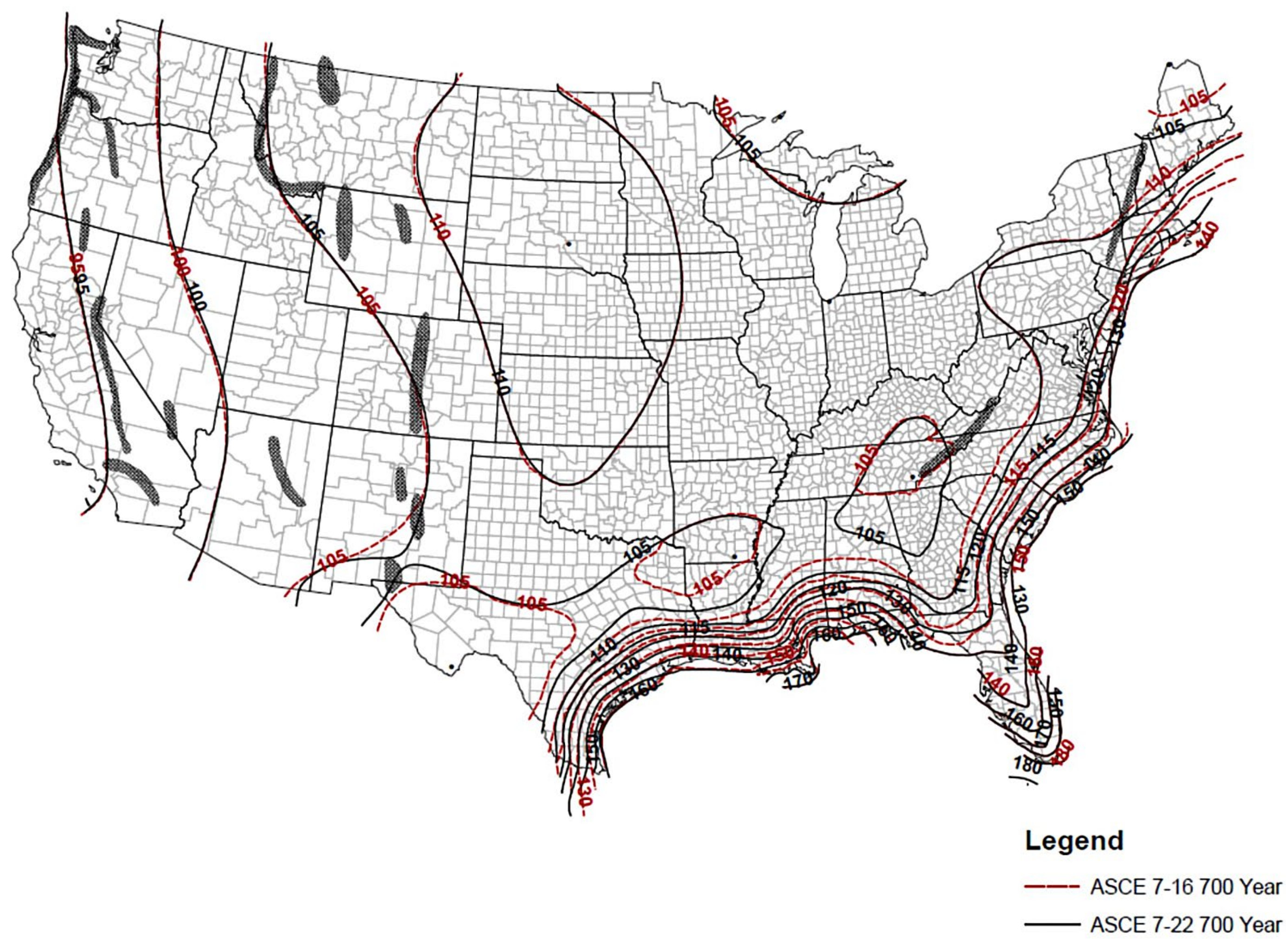
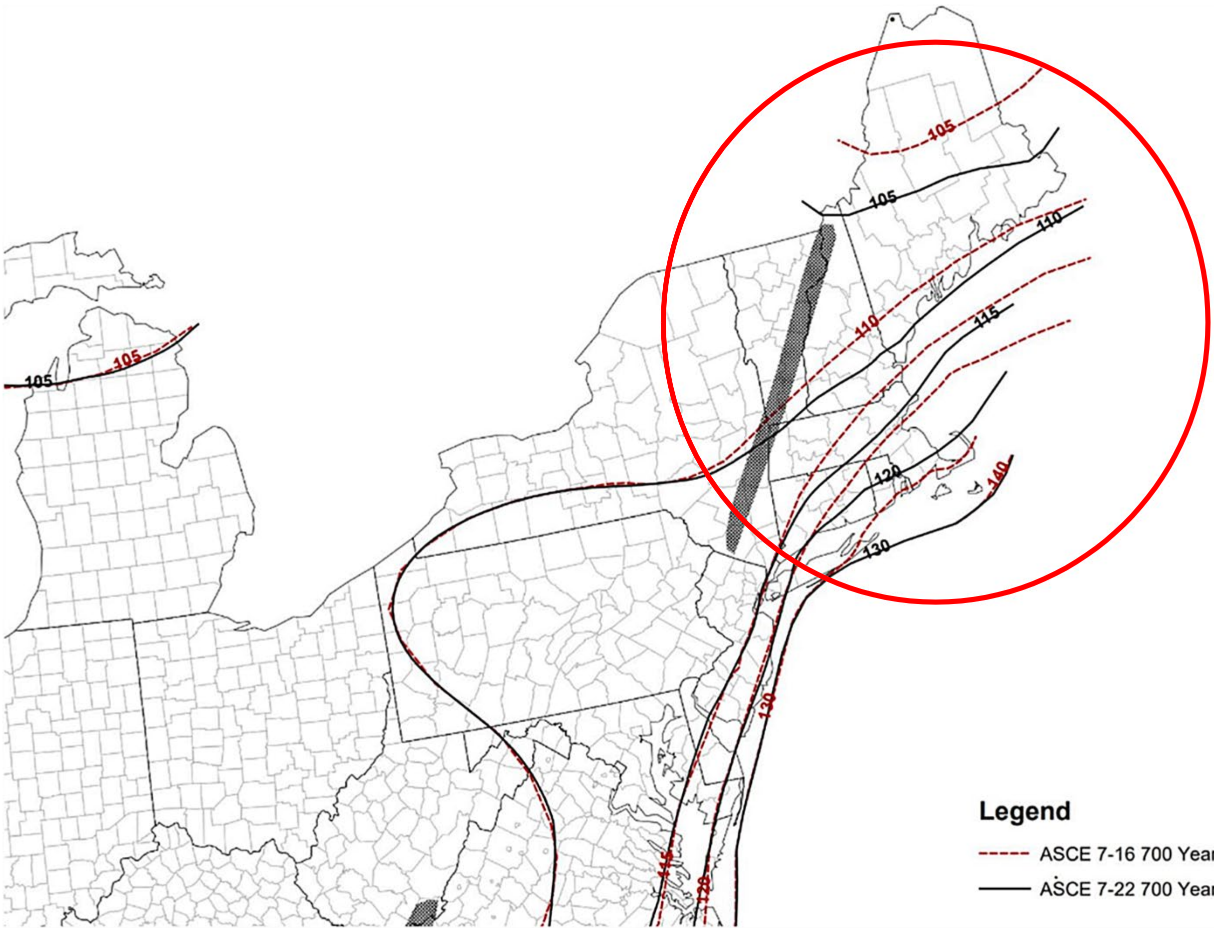
Figure 1 illustrates the changes to the basic wind speeds for Risk Category II buildings and structures in ASCE 7-22. The red dashed contours are the ASCE 7-16 Risk Category II wind speeds. The black contours are the ASCE 7-22 Risk Category II wind speeds. Similar adjustments occur for the Risk Category I, III, and IV maps.

Figure 2 provides a more detailed view of the changes along the North-Atlantic coast. Basic wind speeds for the North-Atlantic region have been decreasing from previous versions for the last three editions of ASCE 7. While wind speed contours have generally moved closer to the coast, reflecting slightly lower wind speeds, the shift of the 130-miles-per-hour (mph) contour completely off the coast is notable. (The 130 mph Risk Category II wind speed is the trigger in the *International Residential Code* for the *Wind Design Required Region* and one of the triggers for the *Wind-borne Debris Region*. The North-Atlantic is now completely out of both regions and conventional construction as permitted in the *International Residential Code* will be permitted throughout the area.)



(Source: Adapted from Figure 26.5-1B of ASCE 7-16 and Figure 26.5-1B of ASCE 7-22 with permission)

Figure 1: Comparison of basic wind speeds for Risk Category II buildings and structures in ASCE 7-16 and ASCE 7-22



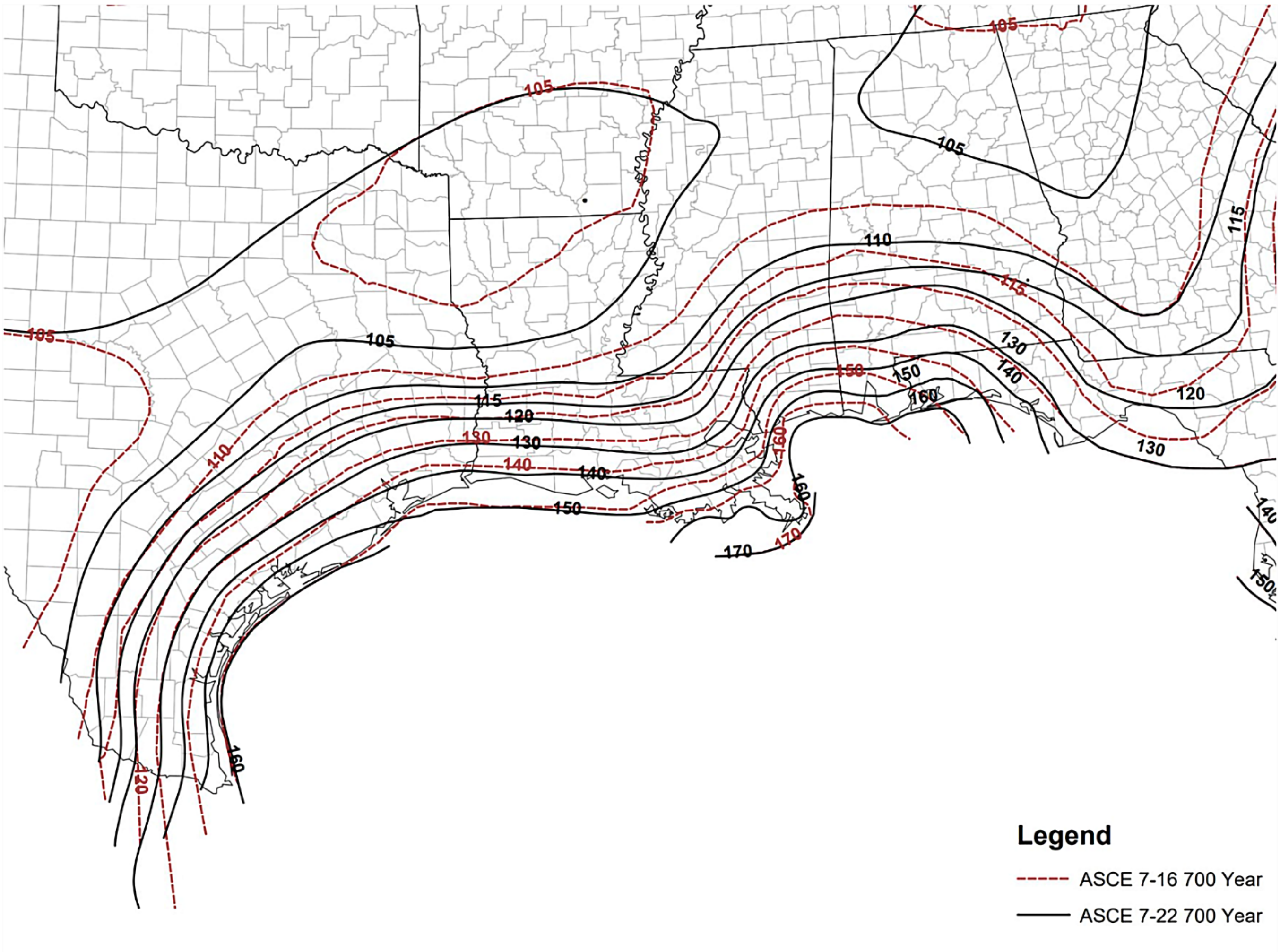
(Source: Adapted from Figure 26.5-1B of ASCE 7-16 and Figure 26.5-1B of ASCE 7-22 with permission)

Figure 2: Basic wind speed changes along the North-Atlantic coast for Risk Category II buildings and structures

Figure 3 provides a more detailed view of the changes along the Gulf coast. Along the south Texas coast, basic wind speeds have increased by approximately 10 mph. Further inland (130 mph and less) wind speeds are slightly lower.

Along the coastal areas of Louisiana, Mississippi, and Alabama wind speeds have generally decreased for most areas. The decrease is more significant in some areas than others. For example, the ASCE 7-16 Risk Category II wind speed for Mobile, Alabama, is 154 mph. In ASCE 7-22, the Risk Category II wind speed is 146 mph (approximately a 5% decrease). For Gulf Shores, Alabama, the wind speed is essentially the same in ASCE 7-22 as it is in ASCE 7-16.

In the Florida panhandle area, wind speeds have increased in some areas of the western part of the panhandle. For example, the ASCE 7-16 Risk Category II wind speed for Destin, Florida, is 142 mph. In ASCE 7-22, the Risk Category II wind speed is 152 mph (approximately a 7% increase). In the big bend area of Florida (informal region of Florida generally stretching from the Apalachicola River to the St. Johns River), the wind speeds have increased from ASCE 7-16, but are essentially the same as they were in ASCE 7-10. (While the 7th Edition (2020) *Florida Building Code* did adopt ASCE 7-16, it did not adopt the ASCE 7-16 Risk Category II basic wind speed map and maintained the ASCE 7-10 Risk Category II basic wind speed map.)



(Source: Adapted from Figure 26.5-1B of ASCE 7-16 and Figure 26.5-1B of ASCE 7-22 with permission)

Figure 3: Basic wind speed changes along the Gulf coast for Risk Category II buildings and structures

Changes to the Wind-borne Debris Region

As with ASCE 7-16, areas within hurricane-prone regions where the basic wind speed is 140 mph or greater are included in the WBDR unconditionally. However, the location of the WBDR has undergone a small but significant change in hurricane-prone regions where the basic wind speed is less than 140 mph but greater than or equal to 130 mph. The locations where the WBDR applies has been revised as follows:

ASCE 7-22

26.12.3.1 Wind-Borne Debris Regions. Glazed openings shall be protected in accordance with Section 26.12.3.2 in the following locations:

- Within 1 mi (1.6 km) of the ~~coastal~~ mean high water line where an Exposure D condition exists upwind of the water line and the basic wind speed is equal to or greater than 130 mi/hr (58 m/s), or
- In areas where the basic wind speed is equal to or greater than 140 mi/h (63 m/s).

The term “coastal mean high-water line” is not a defined term, and its interpretation has varied across jurisdictions in the hurricane-prone region due to confusion about the intent. The new criteria in ASCE 7-22 deletes the word “coastal” and adds language to require that an Exposure D condition exist upwind of the water line. This trigger now applies to locations that are within a mile of any body of water (located in hurricane-prone regions where the basic wind speed is equal to or greater than 130 mph and less than 140 mph) and an Exposure D condition exists upwind of the water line. In hurricane-prone regions, Exposure D applies where a water exposure prevails in the upwind direction for 5000 feet or 20 times the height of the building. The impact of this change is illustrated in Figure 4 for the Panama City area of Florida where the basic wind speed ranges from 130 mph to 140 mph.

For area A, buildings within 1 mile of the mean high-water line of the Gulf of Mexico where the basic wind speed is equal to or greater than 130 mph are clearly within the WBDR. However, for area B, the initial point to measure “1 mile from the coastal mean high-water line” was not clear in ASCE 7-16 and earlier editions. In ASCE 7-22, this ambiguity has been removed. In the bay area (area B), any building located within 1 mile of the mean high-water line of the bay that has exposure to a water surface that prevails for at least 5000 feet from the shoreline will be in the WBDR.

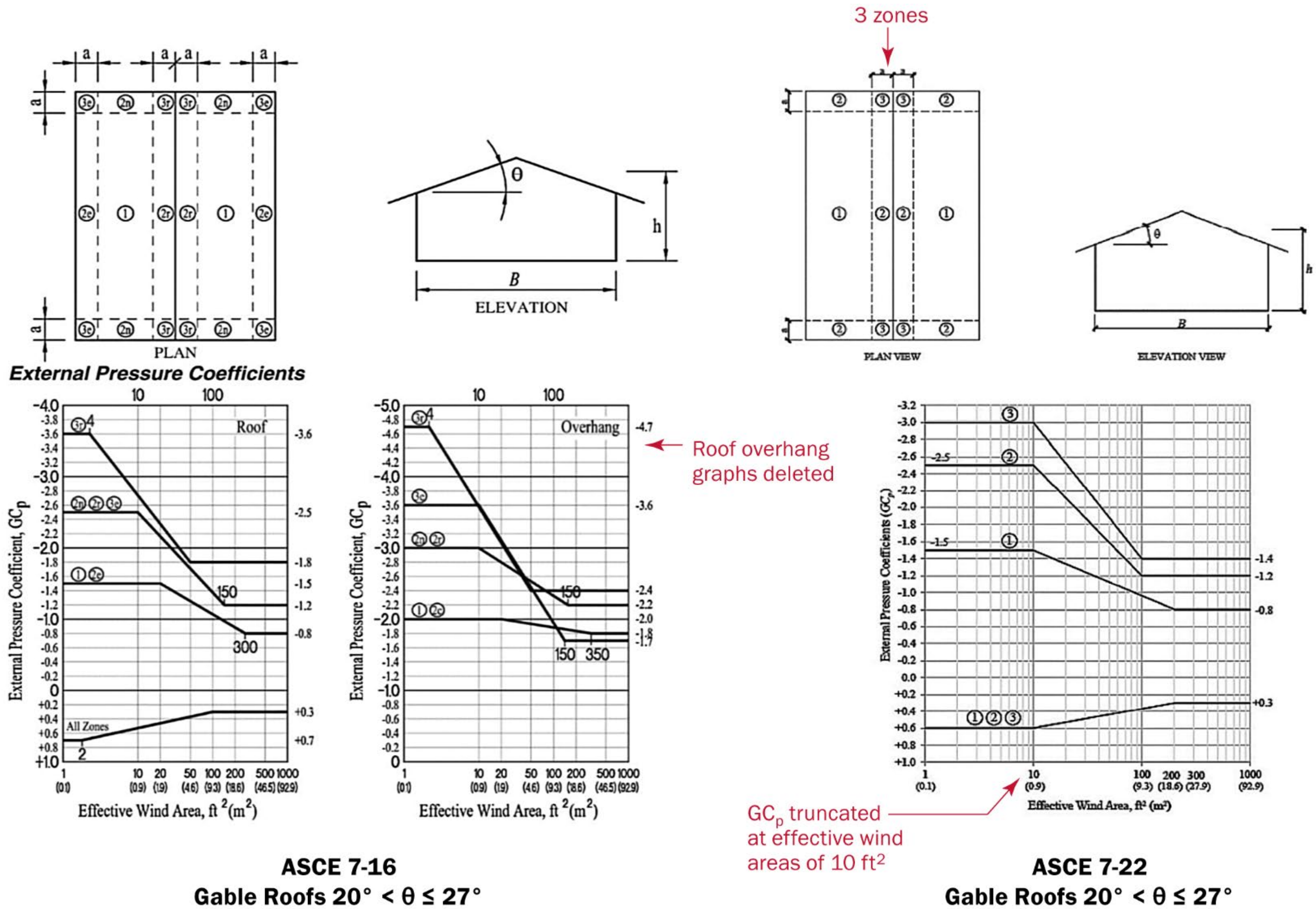
Figure 4: Changes to the location of the WBDR in ASCE 7-22

Changes to External Pressure Coefficients for Roofs of Buildings with Gable and Hip Roofs Having Slopes Greater than 7 Degrees

Component and cladding external pressure coefficients, GC_p, have been revised again in ASCE 7-22 for buildings with gabled and hipped roofs and roof slopes greater than 7°. The changes represent simplifications to the zones on the roofs and lower pressure coefficients for some zones. The external pressure coefficients for flat roofs ($\theta \leq 7°$) are unchanged from ASCE 7-16. For buildings with gable and hip roofs and slopes of $7° < \theta \leq 45°$, the changes include:

- Simplified log graphs with three zones
- All zones truncated at effective wind areas of 10 square feet (ft^2)
- Roof overhang loads determined by summing the roof surface GC_p with the adjacent wall surface GC_p

The changes mostly result in no change or reductions in roof pressure coefficients and corresponding design loads on buildings with roof slopes greater than 7° as compared to ASCE 7-16. However, the change back to three zones greatly simplifies the figures. Figure 5 is an excerpt of Figure 30.3-2C in ASCE 7-16 and ASCE 7-22 and is annotated to provide specific pointers to the changes to the figure. Table 1 highlights the effect of these changes in ASCE 7-22 by providing examples of how the design wind pressure changes for a few select zones.



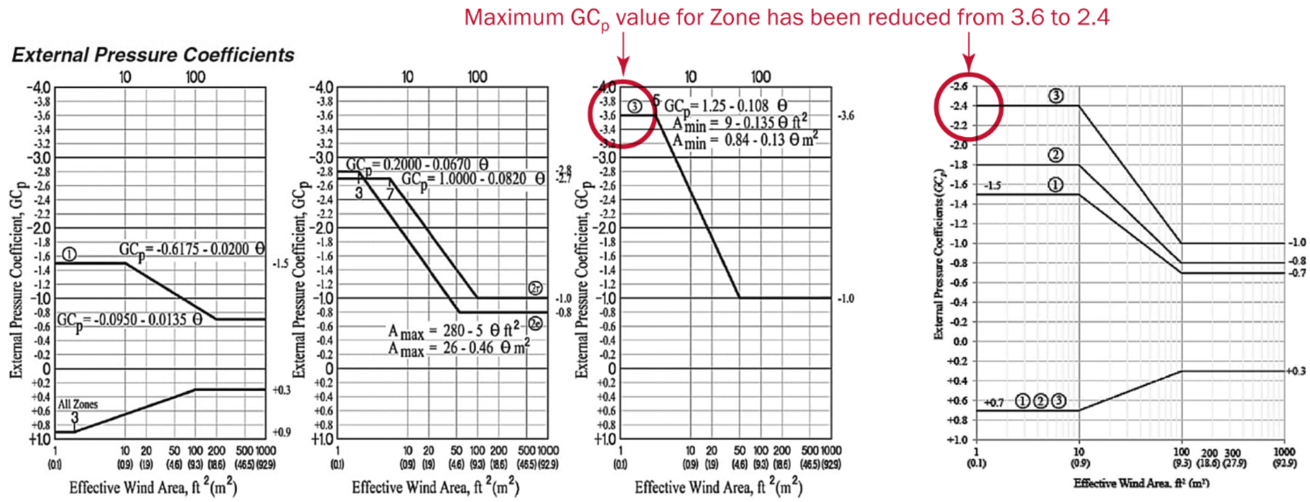
(Sources: ASCE 7-16 and ASCE 7-22)

Figure 5: Annotated excerpt of Figure 30.3-2C in ASCE 7-22 (Gable roofs, 20°< θ ≤ 27°) as compared to ASCE 7-16

Table 1: Example Changes to Roof Component and Cladding Design Pressures for Enclosed Buildings

Zone	ASCE 7-16 GC_p	ASCE 7-22 GC_p	Design Pressure Change for Minimum Effective Wind Area
Gable roofs, 20° < θ ≤ 27°			
3r (ASCE 7-16) 3 (ASCE 7-22)	-3.6	-3.0	-16%
Gable roofs, 27° < θ ≤ 45°			
3e (ASCE 7-16) 3 (ASCE 7-22)	-3.2	-2.5	-21%

External pressure coefficients for hip roofs have been particularly simplified. The delineation of GC_p graphs based on h/B ratios for certain roof slopes has been deleted. Figure 6 provides a representative example of how the determination of external pressure coefficients for hip roofs has been simplified.



ASCE 7-16
Hip Roofs 27° < θ ≤ 45°

ASCE 7-22
Hip Roofs θ = 45°
(Interpolate for roof slopes between 27° and 45°)

(Sources: ASCE 7-16 and ASCE 7-22)

Figure 6: Comparison of External Pressure Coefficients, GCp, for Hip Roofs with θ > 27° from Figure 30.3-2H in ASCE 7-16 and Figure 30.3-2G in ASCE 7-22

Separate graphs for roof overhang external pressure coefficients for gable and hip roofs with slopes 7° < θ ≤ 45°have been deleted. Roof overhang external pressure coefficients for these shapes are now addressed in Section 30.7 and are determined by the sum of the GC_p of the overhang's top and bottom surfaces determined by the applicable roof and wall external pressure coefficients. Figure 7 illustrates the determination of roof overhang external pressure coefficients, GCp.

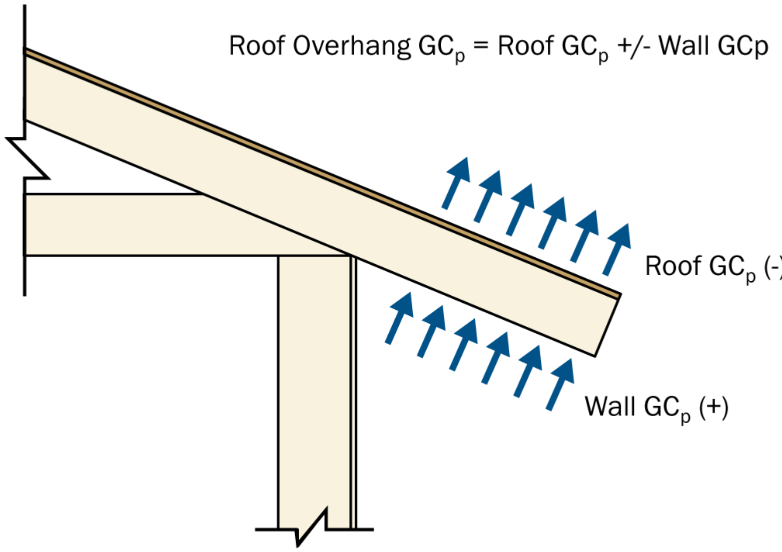


Figure 7: Determination of Roof Overhang GC_p

Other Changes to ASCE 7-22

See the References section for more information on the changes described in this fact sheet and for information on the summary of additional wind loading changes listed below:

- Deletion of the simplified methods (Chapters 27, 28, and 30)
- Revisions to the velocity pressure exposure coefficient, K_z (Section 26.10)
- New Chapter addressing tornado design (Chapter 32, See FEMA's ASCE 7-22 Tornado Loads Fact Sheet: TBD)
- New criteria for roof pavers (Section 30.12)
- New provisions for ground-mounted solar panels (Section 29.4.5)
- Adjustments to the topographic multiplier, K_{zt} (Section 26.8)
- New provisions for Main Wind Force Resisting System and Component and Cladding loads on elevated buildings (Sections 27.3.1.1 and 30.3.2.1)
- Revised wall external pressure coefficients, GC_p, for h > 60 feet (Section 30.4)
- New provisions for attached canopies on buildings with h > 60 feet (Section 30.9)
- Roof pressure zones for buildings with stepped flat roofs and heights ≤ 60 feet have been updated to reflect the appropriate flat roof pressure zones (Figure 30.3-3)
- New design wind speed maps that include topographic speedup effects have been added for Puerto Rico and the U.S. Virgin Islands. These mapped design wind speeds, as well as mapped design wind speeds for Hawaii which incorporated topographic speedup effects in ASCE 7-16, are only available through the ASCE 7 Hazard Tool (asce7hazardtool.online).

References

ASCE. 2017. ASCE 7-16. *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*. American Society of Civil Engineers.

ASCE. 2021. ASCE 7-22. *Minimum Design Loads and Associated Criteria for Buildings and Other Structures*. American Society of Civil Engineers.