2017

FORTIFIED COMMERCIAL Standards

HURRICANE

FORTIFIED is a program of the Insurance Institute for Business & Home Safety

Insurance Institute for Business & Home Safety®

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1 Introduction

The Insurance Institute for Business & Home Safety's (IBHS) FORTIFIED Commercial program addresses specific natural hazard risks, and provides recommendations for reducing damage particular to that risk. FORTIFIED Commercial™–Hurricane standards help building owners improve their commercial structure's ability to resist damage from hurricanes and tropical storms. Incorporating FORTIFIED features when building or retrofitting will transform a commercial building into a more resilient and durable asset.

Hurricane-Prone Regions: Areas vulnerable to hurricanes as defined in ASCE 7 are considered hurricane-prone regions.

- For ASCE 7-05, hurricane-prone regions are locations along the Gulf of Mexico and Atlantic coasts where the design wind speed is greater than 90 mph, plus Hawaii, Puerto Rico, the Virgin Islands, Guam, and American Samoa.

- For ASCE 7-10 and 7-16, hurricane-prone regions are locations along the Gulf of Mexico and Atlantic coasts where the wind speed for Risk Category II buildings is greater than 115 mph, plus Hawaii, Puerto Rico, the Virgin Islands, Guam, and American Samoa.

For areas NOT located in a hurricane-prone region as defined in ASCE 7, see the IBHS FORTIFIED Commercial–High Wind & Hail standards.

FORTIFIED Commercial employs an incremental approach toward making new and existing commercial buildings more resistant to damage from severe weather. With three levels of FORTIFIED Commercial designation available—Bronze, Silver and Gold—builders can work with owners to choose a desired level of protection that best suits their budgets and resilience goals.

For more detailed information about how to make your commercial building stronger, please visit DisasterSafety.org/FORTIFIED. You also can contact:

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2 Program Overview

2.1 Bronze Level: Enhanced Roof Performance

- Roof-related components and connections shall meet ASCE 7 wind load requirements with a factor of safety as defined in Section 3.1.1.3 Roof Design Load Requirements.
    - For ASCE 7-05 based design, appropriate Risk Category and Importance Factor shall be used, with minimum Risk Category II being required.
    - For ASCE 7-10 and 7-16 based design, appropriate Risk Category design wind speed is required, with Minimum Risk Category II being required.
- Roof-related components include:
    - Roof cover anchorage and condition
    - Roof cover edge flashing and attachment
    - Roof deck attachment and anchorage of cantilever overhangs
    - Gutter strength/attachment
    - Anchorage of roof-mounted structures and equipment
    - Skylight pressure rating and impact resistance

2.2 Silver Level: Bronze Requirements Plus Building Envelope Protection and Continuity of Business Operations

- All glazed openings shall be protected to minimize water and wind/wind pressure intrusion.
- Wall systems shall be designed with code-specified wind pressure resistance and impact resistance similar to that for protected glazed openings.
- Exterior entry doors shall be rated for the code-specified wind pressure resistance and are either impact-rated or protected by a qualified impact-rated system.
- Large exterior commercial doors shall be rated for the code-specified wind pressure resistance.

- Parapets and false fronts shall be adequately braced and anchored.
- Electrical and mechanical equipment and connections shall be protected from flood/water damage.
- Enhanced continuity of electrical utilities for critical systems shall be provided to maintain/quickly restore business operations.

2.3 Gold Level: Silver Requirements Plus Enhanced Structural Performance

- A continuous load path shall be verified from roof to ground to resist both uplift and lateral loads.
- Canopies shall be adequately anchored/supported.
- Backup power shall be provided.

2.4 Other Considerations: Flood and Hail

2.4.1 Flood

While protecting electrical and mechanical systems from flood is a requirement of the Silver Level, whole-building protection against the flood hazard is not be required under FORTIFIED Commercial. However, IBHS strongly recommends the following mitigation steps be taken for FEMA-designated flood zones including V, A, B, D, and X-shaded:

- Elevate the building's first finished floor above the 500-year flood level (if known) or 3 ft above the Base Flood Elevation (BFE) for the property. If the building is not sufficiently elevated as described above, it is recommended that dry flood protection such as flood gates, walls or doors, inflatable barriers, sand bags or similar devices be used to prevent water intrusion to the heights described above. Flood depth, duration, velocity, and condition of water should be considered (including floating debris).
- Buildings should have a check valve or similar backflow device installed at the point of entry into the building on the sanitary line to prevent sewage from potentially flowing back into the building during a flood.

2.4.2 Hail

The hail hazard is NOT required to be mitigated under FORTIFIED Commercial–Hurricane. However, if located in a hail-prone area as shown in Figure 1, IBHS recommends a hail-resistant roof cover that meets the standards listed under the Hail-Related Performance Criteria for Roofing below.

Hail-Prone Counties

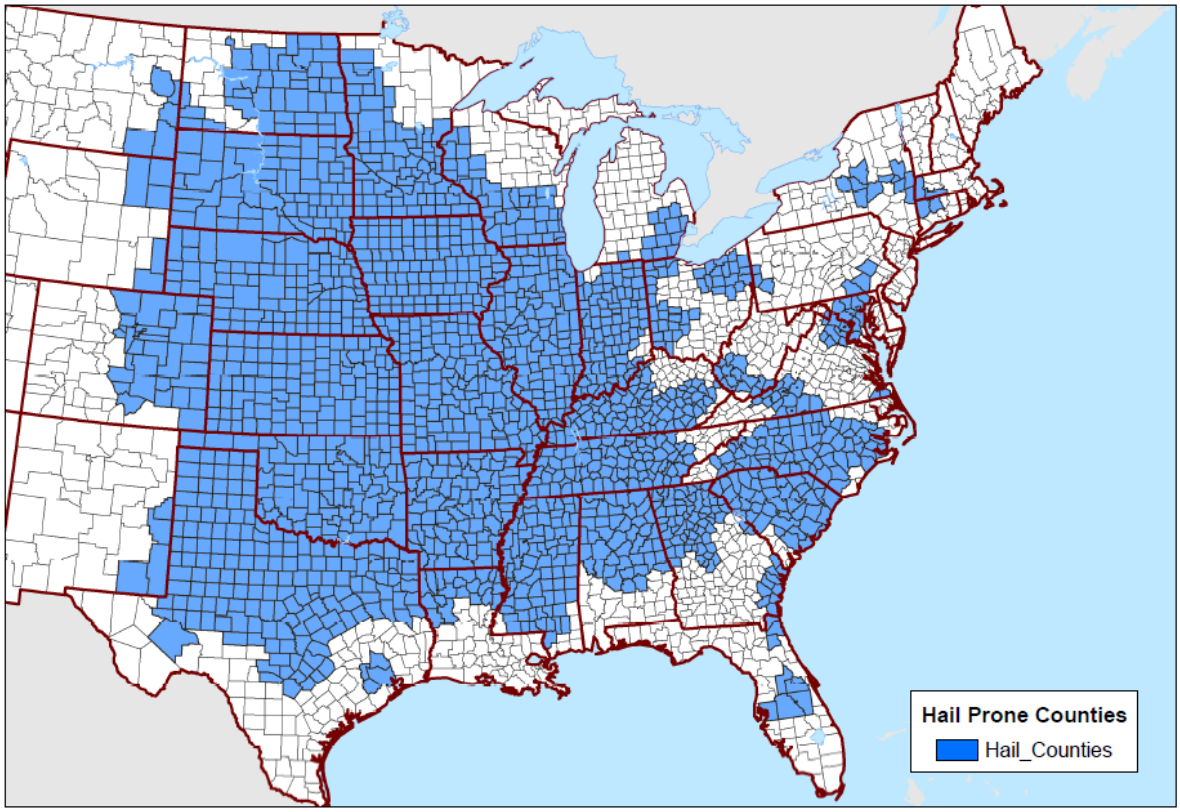

Figure 1. The hail-prone counties shown here are based on hail reports compiled by the Storm Prediction Center. Counties in blue are subject to a high frequency of damaging hailstorms with a maximum hailstone size of 1 in. or larger. Source: IBHS

Hail-Related Performance Criteria for Roofing

Roof covers for low-sloped roofs (≤14° or less than 3/12 pitch):

- FM Approval Standard 4470 with a Class 1-SH or 1-VSH
- UL 2218 Class 4

Roof covers for steep-sloped roofs (>14° or greater than 3/12 pitch):

- FM Approval Standard 4473 Class 4
- UL 2218 Class 4

3 FORTIFIED Commercial Requirements

3.1 Hurricane Bronze

3.1.1 Roof System Overview

Eligible roof cover systems include class A fire rated (UL, ASTM or FM) new roofs that are part of new construction or replacement roof covers when an existing roof cover system is completely removed and stripped down to the roof deck. Roof systems shall meet the wind uplift load requirements specified in section 3.1.1.3.

Exception: Existing roof cover systems that receive an initial satisfactory FORTIFIED evaluation within 10 years of the completed installation of the roof cover system may qualify. An evaluation includes a physical inspection and review of all design and installation documentation. An evaluator may require in-situ tests such as a moisture survey, uplift, or similar test, if sufficient documentation of records is not available.

Ineligible roof cover systems include any **vegetative roof assembly** (including extensive and intensive) as well as any **ballasted roofing system**.

3.1.1.1 Re-Evaluation

To ensure a roof system continues to retain its durability and the building continues to remain eligible for a designation using the IBHS-branded FORTIFIED Commercial–Hurricane program, a re-evaluation shall occur every 5 years, as part of the required re-designation audit. The evaluation will be similar to an initial inspection that includes a physical inspection of the roof cover, roof edge securement, and any roof-related items that may affect the performance of the cover, as well as a review of roof cover design, installation, and maintenance records, repairs, improvements, etc. An evaluator may require an in-situ test such as a moisture survey, uplift or similar test, if sufficient documentation of records is not available.

Since low-sloped (≤14°) roof systems can conceal performance issues due to undetected moisture, leaks and material degradation, and these issues worsen with age, these roof cover systems will ultimately require an in-situ test to maintain their FORTIFIED status. The age

thresholds for testing of low-sloped systems are shown in *Table 1. Low-Sloped (≤14°) Roof Cover Systems.*

3.1.1.2 Re-Roofing

If re-roofing, all roof decks shall be evaluated for any rust, rotting or any other condition that may reduce the integrity of the deck. If the deck includes lightweight insulating concrete, gypsum, cementitious wood-fiber or similar materials, the deck also must be evaluated for moisture, cracks or brittleness. Insulation fastener pull tests shall be conducted.

An option to fastening into the aforementioned decks is to through-fasten, so that fasteners penetrate through the bottom of the structural deck. For example, gypsum and cementitious wood-fiber decks may include through-fastened toggle bolts. Lightweight insulating concrete on steel form may include through-fastened insulation fasteners that penetrate the steel form below the lightweight insulating concrete.

All necessary repairs to the roof deck shall be completed prior to installation of a new roof cover system. If re-roofing, all remaining roof cover components from the previous system shall be evaluated and inspected for moisture, and all wet insulation shall be removed.

Table 1. Low-Sloped (≤14°) Roof Cover Systems

Roof System	FORTIFIED Commercial–Hurricane Eligibility	Evaluation (years)	Age Threshold for Testing (years)
Built-Up Roof	FM Miami-Dade	10	15
Metal Panels (Architectural/non-structural - on substrate)	FM Miami-Dade	10	30
Metal Panels (Structural - on open frames)	FM Miami-Dade	10	20
Modified Bitumen	FM Miami-Dade	10	15
Single-Ply (EPDM, PVC, TPO, KEE, Hypalon, PIB)	FM Miami-Dade	10	15
Sprayed Polyurethane Foam–Coated	FM Miami-Dade	10	10
Ballasted System	NOT ELIGIBLE	N/A	N/A
Vegetative Roof	NOT ELIGIBLE	N/A	N/A

3.1.1.3 Roof Design Load Requirements

For ASCE 7-05 based design, the appropriate Risk Category and Importance Factor shall be used, with a minimum Risk Category II.

For ASCE 7-10 and 7-16 based design, appropriate Risk Category design wind speed shall be used with a Minimum Risk Category II.

Exposure Category shall be determined by the descriptions contained within the Commentary Section of ASCE 7-10.

The minimum required factor of safety is 2.0 for ASCE 7-05 and 7-10, and 1.67 for 7-16 based on allowable stress design (ASD) loads unless a higher factor of safety is required for a particular assembly, system, element, fastener or connection. The ultimate strength of the building assembly, element, fastener or connection shall meet or exceed the load on that assembly, element, fastener or connection using one of the following calculated wind loads:

1. ASCE 7-05 ASD Method: Calculated ASD wind load x 2 (minimum required factor of safety)
2. ASCE 7-05 Load and Resistance Factor Design (LRFD) Method: Calculated LRFD wind load/1.6 x 2 (minimum required factor of safety)
3. ASCE 7-10 ASD Method: Calculated ASD wind load x 2 (minimum required factor of safety)
4. ASCE 7-10 LRFD Method: Calculated LRFD wind load x 0.6 x 2 (minimum required factor of safety)
5. ASCE 7-16 ASD Method: Calculated ASD wind load x 1.67 (minimum required factor of safety)
6. ASCE 7-16 LRFD Method: Calculated LRFD wind load

3.1.2 Wind Design Requirements for Low-Sloped Roof Systems (≤14°)

Low-sloped roof applications with continuous-type membrane roof assemblies such as built-up roof, modified bitumen, single-ply, hybrids, as well as metal panel roofs, must be designed for the appropriate cladding wind pressures of ASCE 7 for the field, perimeter, and corners with the adjustments outlined under the Roof Design Load Requirements in section 3.1.1.3.

3.1.2.1 Low-sloped continuous roof covers

Low-sloped continuous roof covers with any of the following product approvals may be used, provided adjustments are made in design/allowable pressures as outlined in section 3.1.1.3:

- FM Approval Standard 4470 with a **current and active** RoofNav number.

  FM Approval Options:

  - Multiple Systems: Select separate FM approved systems rated for each area—field, perimeter, and the corner.
  - Single System: Select an FM approved system rated for the corner area uplift pressures and use it for the entire roof.
  - Note: For hurricane-prone areas, FM does not permit edge (perimeter/corner) enhancements.

- Miami-Dade County Approved (MDCA) with **current and active** Notice of Acceptance.

  Miami-Dade County Options:

  - Multiple Systems: Select separate Miami-Dade County approved systems rated for each area—field, perimeter, and the corner.
  - Single System: Select a Miami-Dade County system rated for the corner area uplift pressures and use it for the entire roof.
  - Edge (Perimeter/Corner) Enhancements: Select a system rated for the field. Perimeter and corner enhancements can be made in accordance with the Miami-Dade County Notice of Acceptance.

The following example, along with Tables 2 and 3, can be used to help determine the FM or Miami-Dade system needed based on uplift values.

Roof Selection Example

Building Parameters:

- Width: 100 ft
- Length: 100 ft
- Height: 60 ft
- Roof Slope: ≥7° (Low-sloped roof)
- Wind Velocity: 160 mph
- Wind Exposure Category: D
- Risk Category: III
- Escarpment: Flat

Note: Although this is an example of a low-sloped roof without overhangs, roof peaks for roofs with a steep slope (>14°) and overhangs must be addressed when applicable.

Use the ASCE 7-10 figures 30.5-1 (net design wind pressures) to obtain the components and cladding wind pressures for Zone 1, Zone 2 and Zone 3. Use the adjustment factor (λ) from the same figure to account for building height and exposure category. Results are listed in *Table 2. Roof Selection Example Using Wind Design Pressures LRFD and ASD.*

Table 2. Roof Selection Example Using Wind Design Pressures LRFD and ASD

Zone	Ultimate (LRFD) Pressure (psf) from Figure 30.5-1 @ 10 sq ft	Adjustment Factor (h=60 ft and Exposure=D)	Adjusted Ultimate (LRFD) ASCE 7-10 Design Pressures (psf)	Adjusted Allowable (ASD) ASCE 7-05 Design Pressures (psf) [Ultimate x 0.6]
Zone 1	18.7/-46.1	1.87	35.0/-86.2	21.0/-51.7
Zone 2	18.7/-77.3	1.87	35.0/-144.6	21.0/-86.8
Zone 3	18.7/-116.3	1.87	35.0/-217.5	21.0/-130.5
Zone 4	46.1/-50.0	1.87	86.2/-93.5	51.7/-51.6
Zone 5	46.1/-61.7	1.87	86.2/-115.4	51.7/-69.2

Using *Table 3. FM and Miami-Dade Roof Selection* as a guide, use the newly calculated ASD values to select an appropriate FM or Miami-Dade system.

Multiple Systems

Using multiple FM approved systems (see section 3.1.2.1 for more information), Zone 1 (51.7 < 60) shall be a minimum of FM 1-105 rated, Zone 2 (86.8 < 90) shall be a minimum of FM 1-180, and Zone 3 (130.5 < 135) shall be a minimum of FM 1-270.

Using multiple Miami-Dade approved systems (see section 3.1.2.1 for more information), Zone 1 shall be a minimum of Miami-Dade 51.7 rated, Zone 2 shall be a minimum of Miami-Dade 86.8 rated, and Zone 3 shall be a minimum of Miami-Dade 130.5 rated.

Single System

Using a single system, select a roof cover that is sufficient for the corner (Zone 3 [130.5 < 135]) wind uplift pressures. Use an FM 1-270 or a Miami-Dade 135 for all zones of the roof.

Edge (Perimeter/Corner) Enhancements

FM edge (perimeter/corner) enhancements are not permitted.

Using a Miami-Dade approved system, select a roofing system rated for the field. If permitted by the Notice of Acceptance (NOA), edge enhancements may be provided. To calculate these enhancements, refer to the specific system NOA.

Table 3. FM and Miami-Dade Roof Selection

ASCE 7-10 Uplift Values (LRFD) (psf)	ASCE 7-05 Uplift Values (ASD) (psf)	Minimum FM Rated	Minimum Miami-Dade Rated
≤50	≤30	1-60	30
≤62.5	≤37.5	1-75	37.5
≤75	≤45	1-90	45
≤87.5	≤52.5	1-105	52.5
≤100	≤60	1-120	60
≤112.5	≤67.5	1-135	67.5
≤125	≤75	1-150	75
≤137.5	≤82.5	1-165	82.5
≤150	≤90	1-180	90
≤170.8	≤102.5	1-205	102.5
≤175	≤105	1-210	105
≤195.8	≤117.5	1-235	117.5
≤200	≤120	1-240	120
≤212.5	≤127.5	1-255	127.5
≤225	≤135	1-270	135
≤237.5	≤142.5	1-285	142.5
≤250	≤150	1-300	150
≤262.5	≤157.5	1-315	157.5
≤275	≤165	1-330	165
≤287.5	≤172.5	1-345	172.5
≤300	≤180	1-360	180
≤312.5	≤187.5	1-375	187.5
≤325	≤195	1-390	195
≤337.5	≤202.5	1-405	202.5

Note: Available uplift values and approvals may exceed the values included in this table.

3.1.2.2 Ballasted low-sloped single-ply roof systems

Ballasted low-sloped single-ply roof systems shall NOT be permitted in hurricane-prone areas. This includes loose-laid stone and pavers.

3.1.2.3 Vegetative roof systems

Vegetative roof systems shall NOT be permitted in hurricane-prone areas. This includes intensive, simple intensive (semi-intensive) and extensive green roof systems.

3.1.2.4 Peel-stop

Fully adhered single-ply roofs shall include a perimeter peel-stop with a termination bar or similar, located 1–2 ft from the roof edge.

3.1.2.5 Edge flashing, coping, and counter flashing

Edge flashing, coping, and counter flashing shall be designed and tested in accordance with ANSI/SPRI/FM 4435/ES-1 for the ASCE 7 design wind pressures.

3.1.2.6 Structural metal panel roof systems on spaced supports and nonstructural standing seam metal roof panels on solid wood sheathing

Structural metal panel roof systems on spaced supports and nonstructural standing seam metal roof panels on solid wood sheathing with any of the following product approvals shall be permitted, provided adjustments are made in design/allowable pressures as outlined in section 3.1.1.3 and 3.1.2.1:

- FM Approval Standard 4470 or 4471 with current and active RoofNav number.
- Miami-Dade County Approved (MDCA) with current Notice of Acceptance.

3.1.2.7 Gutter, downspouts, and hold-downs

Gutter, downspouts, and hold-downs shall be designed in accordance with ANSI/SPRI GD-1 with the adjustments in design/allowable pressures outlined in section 3.1.1.3, or an FM Approved gutter system with additional gutter brackets in accordance with FM Loss Prevention Data Sheet 1-49 shall be used.

3.1.2.8 Structural roof deck

Structural roof deck attachments shall be designed for field, perimeter, and corner component and cladding wind pressures requirements of ASCE 7 for the building location with the adjustments in design/allowable pressures outlined in section 3.1.1.3.

3.1.2.9 Structural members of cantilever overhangs

Structural members of cantilever overhangs must be adequately anchored and designed for the ASCE 7 design wind pressures with adjustments to the design/allowable pressures outlined in section 3.1.1.3.

3.1.3 Wind Design Requirements for Steep-Sloped Roofs (>14°)

3.1.3.1 Sealed Roof Deck for Asphalt Shingles or Metal Roof Panels

The roof deck shall be sealed using one of the following options:

- **Taping of Seams Between Roof Sheathing:** All seams between roof sheathing that forms the roof deck shall be taped using either an ASTM D1970 compliant self-adhering polymer-modified bitumen flashing tape at least 4 in. wide or an AAMA 711-13, Level 3 (for exposure up to 80°C/176°F) compliant self-adhering flexible flashing tape at least 3¾ in. wide. The roof surface shall be covered with a code-compliant ASTM D226 Type II or ASTM D4869 Type IV underlayment over the self-adhering tape. As an alternative, apply a reinforced synthetic roof underlayment which has an ICC approval as an alternate to ASTM D226 Type II felt paper. The synthetic underlayment shall have a minimum tear strength of 20 lb per ASTM D5034 or ASTM D4533. The underlayment shall be attached using annular ring or deformed shank roofing fasteners with minimum 1-in.-diameter caps (button cap nails) at minimum 6 in. o.c. spacing along all laps and two (2) rows 12 in. o.c. spacing in the field. Horizontal laps must be a minimum of 2 in. and end laps must be a minimum of 6 in.

  Notes:

  - Weave underlayment across valleys.
  - Double-lap underlayment across ridges (unless there is a continuous ridge vent).
  - Lap underlayment with minimum 6-in. leg “turned up” at wall intersections; lap wall weather barrier over turned-up roof underlayment.

- **Double layer of Felt:** Two (2) layers of ASTM D226 Type II or ASTM D4869 Type IV underlayment shall be installed in a shingle-fashion, lapped 19 in. on horizontal seams

(36-in.-wide roll), and 6 in. on vertical seams. The starter course of felt is to be cut 19 in. wide and installed along the eave. Install a 36-in.-wide roll of ASTM D226 Type II or ASTM D4869 Type IV underlayment over the 19-in.-wide course also along the eave. Overlap subsequent sheets 19 in. leaving 17 in. exposed up to the ridge. The underlayment shall be attached using annular ring or deformed shank roofing fasteners with minimum 1-in.-diameter caps (button cap nails) at minimum 6 in. o.c. spacing along all laps and 12 in. o.c. spacing in the field.

Notes:

- Weave underlayment across valleys.
- Double-lap underlayment across ridges (unless there is a continuous ridge vent).
- Lap underlayment with minimum 6-in. leg “turned up” at wall intersections; lap wall weather barrier over turned-up roof underlayment.

- **Self-Adhered Membrane:** The entire roof deck shall be covered with a full layer of self-adhering polymer-modified bitumen membrane conforming to ASTM D1970 requirements.

  Notes:

  - In some instances, the ability of the self-adhered membranes to adhere to Oriented Strand Board (OSB) sheathing may be compromised by the level of surface texture, wax used to improve the water resistance of the OSB panels, and/or the job site conditions. In applications where membrane adhesion to OSB is marginal, apply a primer to the OSB panels to ensure the proper attachment of the self-adhering membrane to the sheathing.
  - Roofers are finding that shingles are bonding to many of these membranes and this could lead to damage of the sheathing when it comes time to replace the shingles. Consequently, the membrane should be covered with a bond break such as a ASTM D226 Type I underlayment. This underlayment on shingle roofs only needs to be fastened sufficiently enough to keep it on the roof surface until the shingles are applied.
  - Roof covering manufacturers emphasize the need for adequate attic ventilation when a self-adhering membrane is applied over the entire roof. Also, some local building departments prohibit the use of this system. Check with the local building department for restrictions.

3.1.3.1.1 Shingles

Shingles shall be high-wind rated based on design wind speed. See *Table 4. Wind Classification of Asphalt Shingles.*

Table 4. Wind Classification of Asphalt Shingles

ASCE 7-05 Wind Speed (V_{asd})	ASCE 7-10/7-16 Wind Speed (V_{ult})	Shingle Wind Testing Standard/Classification
100 MPH	129 MPH	ASTM D3161 (Class F) or ASTM D7158 (Class G or H)[1]
110 MPH	142 MPH	ASTM D3161 (Class F) or ASTM D7158 (Class G or H)[1]
120 MPH	155 MPH	ASTM D7158 (Class G or H)[1]
130 MPH	168 MPH	ASTM D7158 (Class H)[1]
140 MPH	180 MPH	
150 MPH	194 MPH	

[1] **Note: When used in Exposure D locations, shingles must pass both ASTM D3161 Class F and ASTM D7158 Class H testing standards.**

3.1.3.1.2 Architectural metal panels

Metal panel roofing systems and their attachments shall be installed in accordance with the manufacturer's installation instructions and shall provide uplift resistance equal to or greater than the design uplift pressure for the roof based on requirements in section 3.1.1.3.

The metal panels shall be installed over continuous decking and one of the acceptable sealed roof deck underlayment options from section 3.1.3.1 and 3.1.2.1.

3.1.3.2 Sealed roof decks: clay and concrete roof tiles

The roof deck shall be sealed using one of the following options:

- **Self-Adhered Membrane:** The entire roof deck shall be covered with a full layer of self-adhering polymer-modified bitumen roof tile underlayment membrane conforming to ASTM D1970 and Florida Building Code TAS 103 requirements. If used as roof tile underlayment, must meet the field, perimeter and corner uplift design pressures.
    - In some instances, the ability of the self-adhered membranes to adhere to Oriented Strand Board (OSB) sheathing may be compromised by the level of surface texture, the wax used to release the OSB panel from its mold during the manufacturing process, and the job site conditions. In applications where membrane adhesion to OSB is marginal, apply a primer to the OSB panels to ensure the proper attachment of the self-adhering membrane to the sheathing.
    - Roof covering manufacturers emphasize the need for adequate attic ventilation when a self-adhering membrane is applied over the entire roof. Also, some local building departments prohibit the use of this system. Check with the local building department for restrictions.
- **Taping of Seams Between Roof Sheathing and Self-Adhering Membrane over Underlayment:** All seams between roof sheathing that forms the roof deck shall be taped using either an ASTM D1970 compliant self-adhering polymer-modified bitumen flashing tape at least 4 in. wide or an AAMA 711-13, Level 3 (for exposure up to 80°C/176°F) compliant self-adhering flexible flashing tape at least 3¾ in. wide. Over the self-adhering tape, the roof surface shall be covered with a code-compliant ASTM D226 Type II or approved equal anchor sheet. The anchor sheet shall be attached using annular ring or deformed shank roofing fasteners with minimum 1-in.-diameter caps (button cap nails) at minimum 6 in. o.c. spacing along all laps and two (2) rows 12 in. o.c. spacing in the field. Horizontal laps must be a minimum of 2 in. and end laps must be a minimum of 6 in. A self-adhering polymer-modified bitumen cap sheet complying with ASTM D1970 shall be applied over this underlayment.

  Notes:
    - Weave underlayment across valleys.
    - Double-lap underlayment across ridges (unless there is a continuous ridge vent).
    - Lap underlayment with minimum 6-in. leg “turned up” at wall intersections; lap wall weather barrier over turned-up roof underlayment.

- **Taping of Seams Between Roof Sheathing and Hot-Mopped #90 Mineral Surface Cap Sheet over Underlayment:** All seams between roof sheathing that forms the roof deck shall be taped using either an ASTM D1970 compliant self-adhering polymer-modified bitumen flashing tape at least 4 in. wide or an AAMA 711-13, Level 3 (for exposure up to 80°C/176°F) compliant self-adhering flexible flashing tape at least 3¾ in. wide. The roof surface shall be covered with a code-compliant ASTM D226 Type II anchor sheet or approved equal base sheet over the self-adhering tape. The anchor sheet shall be attached using annular ring or deformed shank roofing fasteners with minimum 1-in.-diameter caps (button cap nails) at minimum 6 in. o.c. spacing along all laps and two (2) rows 12 in. o.c. spacing in the field. Horizontal laps must be a minimum of 2 in. and end laps must be a minimum of 6 in. The underlayment shall be hot-mopped using hot asphalt and a #90 mineral surface cap sheet or approved modified cap sheet shall be applied.

  Notes:

  - Weave underlayment across valleys.
  - Double-lap underlayment across ridges (unless there is a continuous ridge vent).
  - Lap underlayment with minimum 6-in. leg “turned up” at wall intersections; lap wall weather barrier over turned-up roof underlayment.

- **Double layer of Felt:** Two (2) layers of ASTM D226 Type II or ASTM D4869 Type IV underlayment shall be installed in a shingle-fashion, lapped 19 in. on horizontal seams (36-in.-wide roll), and 6 in. on vertical seams. The starter course of felt is to be cut 19 in. wide and installed along the eave. Install a 36-in.-wide roll of ASTM D226 Type II or ASTM D4869 Type IV underlayment over the 19-in.-wide course also along the eave. Overlap subsequent sheets 19 in. leaving 17 in. exposed up to the ridge. The underlayment shall be attached using annular ring or deformed shank roofing fasteners with minimum 1-in.-diameter caps (button cap nails) at minimum 6 in. o.c. spacing along all laps and 12 in. o.c. spacing in the field.

  Notes:

  - Weave underlayment across valleys.
  - Double-lap underlayment across ridges (unless there is a continuous ridge vent).
  - Lap underlayment with minimum 6-in. leg “turned up” at wall intersections; lap wall weather barrier over turned-up roof underlayment.

The two-ply felt shall be covered with a code-compliant ASTM D226 Type II anchor sheet or approved equal base sheet. The anchor sheet shall be attached using annular ring or deformed

shank roofing fasteners with approved minimum 1-in.-diameter caps (button cap nails) at minimum 6 in. o.c. spacing along all laps and two (2) rows 12 in. o.c. spacing in the field. Horizontal laps must be a minimum of 2 in. and end laps must be a minimum of 6 in. The tile underlayment shall be hot-mopped, self-adhered, cold-applied, heat-applied or mechanically attached following the **FRSA/TRI Florida High Wind Concrete and Clay Tile Installation Manual for High Wind Applications Fifth Edition.**

The double layer was not tested as an anchor sheet.

3.1.3.2.1 Clay and Concrete Tiles

Clay and concrete roof tile systems and their attachments shall meet the requirements in section 3.1.1.3.

For design wind speeds based on ASCE 7-10 and 7-16, clay and concrete roof tiles shall be installed in accordance with FRSA/Tile Roofing Institute installation guidelines, “Concrete and Clay Roof Tile Installation Manual, Fourth Edition, FRSA/TRI 07320/08-05.” Tables in this edition are based on ASCE 7-02.

For design wind speeds based on 2015 IRC (ASCE 7-10), clay and concrete roof tiles shall be installed in accordance with FRSA/Tile Roofing Institute installation guidelines, “Florida High Wind Concrete and Clay Roof Tile Installation Manual, Fifth Edition, FRSA/TRI April 2012 (04-12).”

Mortar-set tile or mortar-set hip and ridge tiles (Systems Three and Four B, as listed in FRSA/TRI Manual) are not permitted. Hip and ridge boards shall be attached to the roof framing to resist the uplift pressure for the site design wind speed and exposure or in accordance with Table 11 of the FRSA/Manual. Hip and ridge tiles shall be secured to hip and ridge boards with mechanical fasteners and/or an approved roof tile adhesive.

3.1.3.3 Other Roof Coverings

For all other roof coverings, the designer must provide documentation showing the roof covering and the attachments were designed for the component and cladding wind pressures corresponding to areas to section 3.1.1.3.

3.1.4 Gables End Walls and Overhangs

3.1.4.1 Gable overhangs

Gable overhangs shall not be vented.

3.1.4.2 Gable overhangs using outlooker framing

Gable overhangs using outlooker framing shall have adequate connection at gable wall and at roof framing members. Connections shall be designed by a licensed professional engineer or developed using prescriptive connection details available from IBHS.

3.1.4.3 Box-type soffit overhangs (eave) and gable overhangs

Box-type soffit overhangs (eave) and gable overhangs with a depth of greater than 12 in. (measured from the back of fascia to exterior wall surface) and covered with aluminum or vinyl material shall have a center brace installed mid-span.

3.1.4.4 Gable walls

Gable walls shall have minimum of $^{7}/_{16}$-in. structural sheathing (plywood or OSB) or equivalent wall sheathing.

3.1.4.5 Gable end walls

Gable end walls on gables greater than 48 in. in height must be braced to withstand the ASCE 7 wind loads. A bracing design by a licensed professional engineer is required. Bracing shall be installed per design. As an alternate, bracing details provided in the International Existing Building Code Appendix “C” or in the Florida Building Code may be used.

3.1.4.6 Gable wall vents

Gable wall vents shall be protected against water intrusion.

3.1.5 Attic Ventilation System

Roof-mounted vents, including but not limited to ridge vents, off-ridge vents, and turbines, shall meet the requirement of Florida Building Code TAS 100 (A).

3.1.6 Skylights

Skylights and their attachments shall be designed and detailed for the ASCE 7 wind speed and provide an uplift resistance with a minimum factor of safety as described in section 3.1.1.3. Installation shall meet the air and water infiltration requirements of ASTM E330 and E331. The curb installation shall be confirmed by a licensed professional engineer that it will meet the required uplift minimum factor as described in section 3.1.1.3.

- When the ASCE 7-05 design wind speed is ≥100 mph (ASCE 7-10 and 7-16 when appropriate Risk Category design wind speed is ≥120 mph), large missile impact-resistant skylights are required. They shall meet, at a minimum, ASTM E1886 cyclic pressure test requirements and be ASTM E1996 large missile impact-rated.

- When the ASCE 7-05 wind speed is ≥130 mph (ASCE 7-10 and 7-16 when appropriate Risk Category design wind speed is ≥165 mph), skylights shall also meet AAMA 520-09.

- Options for approved skylight systems include:

    - FM Approved per ANSI FM 4431, with large missile impact rating

    - Miami-Dade County Approved, with large missile impact rating

3.1.7 Roof-Mounted Equipment

3.1.7.1 Roof-mounted structures

Roof-mounted structures and equipment and their attachments shall be designed in accordance with ASCE 7-10 Section 29.5.1 “Rooftop Structures and Equipment for Buildings with h ≤ 60 ft” or ASCE 7-16 Section 29.4 “Rooftop Structures and Equipment for Buildings.” They shall be designed with a minimum factor of safety 2.0 for ASCE 7 ASD loads (1.67 for ASCE 7-16 based ASD design loads).

3.1.7.2 Photovoltaic (PV) systems

Photovoltaic (PV) systems and their attachments shall be designed using wind loads in accordance with ASCE 7-16, SEAOC PV2, or a model-scale wind tunnel study that meets the requirements of ASCE 49-12. A minimum factor of safety as described in section 3.1.1.3 is required. The roof deck shall be designed to support the increased PV array loads, including live loads such as rain, snow (including snow drifts), etc.

Also eligible are:

- Rigid PV modules that are FM Approved or meet FM Approval Standard 4478 (wind uplift, combustibility from above the deck).

- Flexible PV modules that are FM Approved or meet FM Approval Standard 4476.

RECOMMENDED (not required) for PV system hail protection:

- Flexible PV modules that are FM Approved for hail or meet FM Approval Standard 4476 that includes a Severe Hail rating.

- Rigid PV modules that are FM Approved for hail or meet FM Approval Standard 4478 that includes a Class 4 rating.
- Rigid modules that meet UL 1703 Standards for Flat-Plate Photovoltaic Modules and Panels.

3.1.7.3 Additional PV building risks recommendations

While this document focuses on wind loads and hail risks for PV systems, IBHS strongly recommends that all additional building risks be addressed including: structural loading on the roof deck; increased combustibility from above the deck which may lead to re-classification of the exterior fire rating of the roof cover system; snow, hail, seismic, electrical and fire hazards; and firefighting hazards. Periodic inspection, maintenance, and repair should include the prevention of roof cover puncturing, debris accumulation, and proper water shedding of the roof cover to allow drainage, which will prevent overloading of the roof. The use of a cover board is recommended in new roof cover systems to increase puncture resistance.

3.2 Hurricane Silver

All Bronze requirements shall be satisfied.

3.2.1 Openings

3.2.1.1 Windows, curtain walls, sliding doors and commercial doors

Windows, curtain walls, sliding doors and commercial doors including roll-up, sectional doors, and entrance doors must be pressure rated for pressures associated with the ASCE 7 design wind speed and exposure category “C” or “D” to match the walls below. All openings located within 30 ft of grade shall be impact rated or protected with an impact-rated protection system that, at a minimum, meets ASTM E1886 cyclic pressure and E1996 large missile impact requirements. Glazing 30 ft or higher above grade shall be rated for the design pressure and small missile impact.

3.2.1.2 All glazed openings, including windows, sliding glass doors and exterior personnel doors with or without windows

All glazed openings, including windows, sliding glass doors and exterior personnel doors with or without windows located within 30 ft of grade, shall be impact rated or protected with an impact-rated protection system that, at a minimum, meets ASTM E1886 cyclic pressure and E1996 large missile impact requirements. Glazing 30 ft or higher above grade shall be rated for the design pressure and small missile impact.

3.2.2 Wall Systems

Exposure Category shall be a minimum “C” or “D” as defined by ASCE 7.

3.2.2.1 Exterior walls

Exterior walls shall be capable of resisting ASCE 7 wind loads for the appropriate wall wind pressure zone.

3.2.2.2 Wall impact resistance

Wall impact resistance shall be adequate to meet the requirements of ASTM E1886 and E1996 for the impact of a 9-lb nominal 2- x 4-in. lumber missile impacting end-on at 34 mph (50 ft/s) [large missile impact level D]. Systems that meet the intent of this requirement include but are not limited to: reinforced concrete block masonry; precast concrete; cast-in-place concrete; solid insulated concrete forms; reinforced brick; brick with concrete block backing; metal panel; insulated metal panels; ¾-in. plywood; ≥$^{7}/_{16}$-in. wood structural panel sheathing with one of the following finishes: brick veneer, ½-in. stucco, ½-in.-thick wood, or ½-in. fiber-cement-based planking; and ≥⅝-in.-thick wood structural panel sheathing with vinyl or aluminum siding.

3.2.2.3 Exterior Insulating Finishing Systems (EIFS)

Exterior Insulating Finishing Systems (EIFS) installed on a metal or wood frame shall not be permitted unless they are a **Miami-Dade County Approved** system. EIFS installed over masonry are acceptable. For existing EIFS that meets this criteria, a qualified professional shall inspect the EIFS and provide supporting documentation regarding its condition. EIFS that are not visibly damaged, deteriorated, chipped or cracked, that have structurally sound horizontal and vertical seals including around windows and penetrations, are free of leaks, and have at least 5 years of useful life remaining are eligible for a Silver designation. EIFS that do not meet these conditions and/or do not have at least 5 years of useful life remaining will require repairs or replacement to be eligible for a Silver designation.

3.2.2.4 Parapets

Parapets and false fronts shall be designed for the ASCE 7 wind speed and associated design pressure. Parapets and false fronts greater than 4 ft shall include internal or external bracing with supporting documentation.

3.2.3 Electrical and Mechanical Systems and Connections (Flood Protection)

All electrical and mechanical equipment and connections necessary to operate critical systems shall be elevated at minimum above the 500-year flood level, if known, or 3 ft above the Base Flood Elevation (BFE) for the property. If the equipment cannot be sufficiently elevated as described above, permanent dry flood protection such as flood gates, walls, doors, or similar devices shall be used to prevent water intrusion to the heights described above. Flood depth, duration, velocity and condition of water shall be considered (including floating debris).

3.2.4 Electrical Connections for Backup Power

Electrical connections shall be installed with a transfer switch or docking station (sometimes referred to as a storm switch) in order to support connection of backup power. All connections shall be located above the 500-year flood level if known, or 3 ft above the known Base Flood Elevation or Design Flood Elevation for the property.

3.3 Hurricane Gold

All Bronze and Silver requirements must be satisfied.

3.3.1 Continuous Load Path

A continuous and adequate load path from the roof to the foundation of the building shall be provided. The building shall have positive connections from the roof to foundation as a means to transmit wind uplift and lateral loads safely to the ground. This includes providing:

- Roof-to-wall connection hardware (e.g., hurricane straps for wood) with the required roof uplift resistance as determined by the designer or specified in the prescriptive method being used.
- Continuous load path through the wall to the foundation on inter-story connections in multi-story structures.

The load path shall be designed by a licensed professional engineer and installed per design with supporting documentation verifying the installation.

3.3.2 Attached and Accessory Structures

Convenience store canopies, car ports, porte-cocheres or any other vehicle type drive-through structures shall have adequate load path members and connections to resist design uplift pressures based on site design wind speed and exposure category.

3.3.3 Backup Power

Backup power shall be available and capable of powering critical electrical systems that maintain vital business operations. All equipment shall be installed in accordance with the requirements of Electrical Systems (Flood) described in section 3.2.3.

4 Supporting Documentation

Supporting documentation to be reviewed by a FORTIFIED Commercial Evaluator is needed for each FORTIFIED Commercial requirement and may include any one or a combination of the following:

- Design/development building drawing
- 100% construction drawings signed and sealed by a licensed professional engineer
- A confirmation letter with supporting documentation from a licensed professional engineer stating that the installation meets a specific requirement; the professional engineer should have a license from the state where the referenced building is located
- Photographs
- Building material submittals including but not limited to structural decks and roofing components
- Roof cover attachment details provided by manufacturer/contractor
- Any requested structural engineering calculations
- FORTIFIED Commercial Compliance Forms (including “Project Design Form and Compliance Checklist” and “Project Construction Form”) completed by a licensed architect or professional engineer
- A report by a certified FORTIFIED Commercial Evaluator
- Any other documents requested by the FORTIFIED Commercial Evaluator or IBHS