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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.

Use and Occupancy: Classifications are primarily based on Chapter 3, Section 302 of the 2015 International Building Code. Eligible groups include Assembly, Business, Educational, Factory/Industrial (moderate- and low-hazard factory/industrial only), Institutional, Mercantile, Residential (when not regulated by the International Residential Code), and Storage (moderate- and low-hazard storage). Excluded groups include High-Hazard and appurtenances such as barns, sheds, etc. IBHS has the discretion and reserves the right to determine a building’s eligibility for the program based on use and occupancy.

FORTIFIED Commercial standards are to be applied in conjunction with federal, state and local codes, ordinances and regulations. In case of a conflict between provisions, use whichever regulation is more stringent.
Land Use: FORTIFIED Commercial is not intended to supersede local and municipal policy concerning where it is deemed safe to build commercial structures. Additionally, IBHS believes it is unwise to construct any building in areas that are especially prone to natural hazards. These include low-lying barrier islands and coastal regions, areas in close proximity to known seismic fault lines or major levees, and steep slopes potentially subject to erosion. A FORTIFIED Commercial–designated structure constructed in one of the aforementioned areas will still maintain a reduced risk of damage, but may be more vulnerable than if it were constructed in a less risk-prone area.

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

- **Chuck Miccolis**, Director of Commercial Lines Engineering  
  (813) 675-1056, cmiccolis@ibhs.org

- **Fred Malik**, Director of FORTIFIED Programs  
  (813) 675-1037, fmalik@ibhs.org

- **Christopher Cioffi**, Commercial Lines Engineer  
  (813) 675-1030, ccioffi@ibhs.org

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 (≤10° or less than 2/12 pitch):

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

Roof covers for steep-sloped roofs (>10° or greater than 2/12 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) covers 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 (≤10°) 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 (≤10°) 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.
Table 1. Low-Sloped (≤10°) Roof Cover Systems

<table>
<thead>
<tr>
<th>Roof System</th>
<th>FORTIFIED Commercial–Hurricane Eligibility</th>
<th>Evaluation (years)</th>
<th>Age Threshold for Testing (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Built-Up Roof</td>
<td>FM Miami-Dade</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Metal Panels (Architectural/non-structural - on substrate)</td>
<td>FM Miami-Dade</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>Metal Panels (Structural - on open frames)</td>
<td>FM Miami-Dade</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Modified Bitumen</td>
<td>FM Miami-Dade</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Single-Ply (EPDM, PVC, TPO, KEE, Hypalon, PIB)</td>
<td>FM Miami-Dade</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Sprayed Polyurethane Foam–Coated</td>
<td>FM Miami-Dade</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Ballasted System</td>
<td>NOT ELIGIBLE</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Vegetative Roof</td>
<td>NOT ELIGIBLE</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>
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 a minimum "C" or "D" as defined by ASCE 7.

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 (≤10°)

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 (>10°) 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

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

<table>
<thead>
<tr>
<th>ASCE 7-10 Uplift Values (LRFD) (psf)</th>
<th>ASCE 7-05 Uplift Values (ASD) (psf)</th>
<th>Minimum FM Rated</th>
<th>Minimum Miami-Dade Rated</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤50</td>
<td>≤30</td>
<td>1-60</td>
<td>30</td>
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<tr>
<td>≤62.5</td>
<td>≤37.5</td>
<td>1-75</td>
<td>37.5</td>
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<tr>
<td>≤75</td>
<td>≤45</td>
<td>1-90</td>
<td>45</td>
</tr>
<tr>
<td>≤87.5</td>
<td>≤52.5</td>
<td>1-105</td>
<td>52.5</td>
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<td>1-120</td>
<td>60</td>
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<td>≤112.5</td>
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<td>150</td>
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<tr>
<td>≤337.5</td>
<td>≤202.5</td>
<td>1-405</td>
<td>202.5</td>
</tr>
</tbody>
</table>

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 architectural metal roof panels on solid wood sheathing

Structural metal panel roof systems on spaced supports and nonstructural architectural 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 (>10°)

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

<table>
<thead>
<tr>
<th>ASCE 7-05 Wind Speed ($v_{assd}$)</th>
<th>ASCE 7-10/7-16 Wind Speed ($v_{ult}$)</th>
<th>Shingle Wind Testing Standard/Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 MPH</td>
<td>129 MPH</td>
<td>ASTM D3161 (Class F) or ASTM D7158 (Class G or H)¹</td>
</tr>
<tr>
<td>110 MPH</td>
<td>142 MPH</td>
<td>ASTM D3161 (Class F) or ASTM D7158 (Class G or H)¹</td>
</tr>
<tr>
<td>120 MPH</td>
<td>155 MPH</td>
<td>ASTM D7158 (Class G or H)¹</td>
</tr>
<tr>
<td>130 MPH</td>
<td>168 MPH</td>
<td></td>
</tr>
<tr>
<td>140 MPH</td>
<td>180 MPH</td>
<td>ASTM D7158 (Class H)¹</td>
</tr>
<tr>
<td>150 MPH</td>
<td>194 MPH</td>
<td></td>
</tr>
</tbody>
</table>

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/TTR 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 7-10.

For design wind speeds based on 2015 IRC (ASCE 7-10), clay and concrete roof tiles shall be installed in accordance with FRSA/TTR 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 ASTM 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 ASTM 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 ≥¾-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 meet these 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
Shingle Installation at Roof Edge

Asphalt Shingle Installation at Roof Edges, Intersections and Valleys

Abstract

This updated document is intended to provide additional guidance and options for asphalt shingle installations at roof edges, intersections and valleys. The verification and documentation requirement referenced in the original technical bulletin (Technical Bulletin 2016-05, released November 3, 2016) was effective December 5, 2016.

Introduction

Research conducted at the IBHS Research Center on a number of three-year-old roofs with various edge attachment details clearly demonstrated the need to ensure that shingles are properly installed and well adhered along the perimeter of a roof. While this directive has been included in standards and guidance since the beginning of the program, and also addressed in manufacturers’ high-wind guidance for asphalt shingle installation, it has not been specifically spotlighted in compliance forms or in evaluator training.

As a result, IBHS is issuing this updated technical bulletin to provide additional guidance with options that describe alternate methods to help ensure that asphalt shingles are well sealed and connected at roof edges, intersections and valleys. Please make sure you become familiar with the installation requirements outlined below and work with roofers to ensure proper installation instructions are followed. Additionally, appropriate documentation described at the end of this bulletin continues to be required for all asphalt shingle roof installations.
Sealed Roof Deck Installation Options

Taped Sheathing Seams

Tape Installation
Tape must be rolled to help ensure it is installed flat and adheres to the deck. If the tape doesn’t stick well, the seams must be primed or a different product that does stick well must be used. Recent IBHS experience suggests that there may be fewer adhesion problems for installations on OSB decks with the high temperature–rated acrylic tape allowed by the program.

Underlayment Installation
Apply a code-compliant ASTM D226, Type II underlayment over the self-adhering tape (felt or synthetic is allowed). This underlayment shall be attached using annular ring or deformed shank roofing fasteners with minimum 1-in.-diameter caps at 6 in. o.c. spacing along all laps and two rows 12 in. o.c. in the field or a more stringent fastener schedule if required by the manufacturer for high-wind installations. Horizontal laps shall be a minimum of 2 in. and end laps shall be a minimum of 6 in. Nails with plastic or metal caps are allowed in areas where the design wind speed is less than 140 mph. Metal caps are required for areas where the design wind speed is greater than or equal to 140 mph.

ASTM D1970 Self-Adhered Membranes

ASTM D1970 Membrane Installation
Cover the entire roof with a full layer of self-adhering polymer-modified bitumen membrane meeting ASTM D1970 requirements.

Recommended Bond Break Installation
It is recommended that #15 felt be installed over the membrane to provide a bond break between the self-adhering membrane and the shingles in order to prevent the shingles from fusing with the self-adhering membrane. The bond break shall be held back 8 in. from the eave and rake edges to allow application of flashing cement along the edges to ensure proper sealing of shingles along the roof edges.
Shingle Installation at Roof Edge

Roof Edges, Intersections and Valleys

Drip Edge Installation Requirements
1. Provide code-compliant, minimum gauge metal drip edge at eaves and gables.
2. Overlap to be a minimum of 3 in. at joints.
3. Eave drip edges shall extend ½ in. below sheathing and extend back on the roof a minimum of 2 in.
4. The drip edge shall be mechanically fastened to the roof deck. Fasteners shall be fabricated from similar or compatible material. For FORTIFIED–Hurricane compliance, spacing shall be a maximum of 4 in. o.c. For FORTIFIED–High Wind and FORTIFIED–High Wind & Hail compliance, spacing shall be a maximum of 12 in. o.c. Mechanical fasteners shall be applied in an alternating (staggered) pattern along the length of the drip edge with adjacent fasteners placed near opposite edges of the leg/flange of drip edge on the roof.
5. Drip edge at eaves shall be installed over the underlayment (this is compatible with high-wind installations where flashing cement is used to seal the edges).

Installation of Starter Strips at Eaves (Drip Edge Installed Over Underlayment)
Manufacturer-approved starter strips at eaves shall be set in a minimum 8-in.-wide strip of compatible flashing cement. Maximum thickness of flashing cement shall be ⅛ in. Fasten starter strips parallel to the eaves along a line above the eave line according to the manufacturer’s specifications. Position fasteners to ensure they will not be exposed under the cutouts in the first course. Starter strips and shingles must not extend more than ¼ in. beyond the drip edge.

Approved Option
Shingle manufacturer–approved ASTM D1970 fully adhered (peel-and-stick) starter strip with asphal tic adhesive strip at eave—installed so that starter strip adheres to and covers the drip edge top surface.
Shingle Installation at Roof Edge

Installation of Shingles at Rakes (Drip Edge Installed Over Underlayment)
Install shingles at rakes set in a minimum 8-in.-wide strip of compatible flashing cement. Maximum thickness of flashing cement shall be ⅛ in. Fasten shingles at the rakes according to the manufacturer’s specifications.

Optional Installation of Starter Strips at Rakes (Drip Edge Installed Over Underlayment)
Manufacturer-approved starter strips at rakes shall be set in a minimum 8-in.-wide strip of compatible flashing cement. Maximum thickness of flashing cement shall be ⅛ in. Fasten starter strips parallel to the rakes according to the manufacturer’s specifications. Position fasteners to ensure they will not be exposed. Starter strips and shingles must not extend more than ¼ in. beyond the drip edge.

Approved Option
Shingle manufacturer–approved ASTM D1970 fully adhered (peel-and-stick) starter strip with asphaltic adhesive strip at rake—installed so that starter strip adheres to and covers the drip edge top surface.

Attachment of Shingles at Intersections and Valley
Shingles installed at all intersections and both sides of open valleys shall be set in a minimum 8-in.-wide strip of flashing cement. Maximum thickness of flashing cement shall be ⅛ in. Cut side of closed valleys shall be set in a minimum 2-in.-wide, ⅛-in.-thick strip of flashing cement. Woven valleys to be according to the manufacturer’s specifications.
Verification and Documentation

The contractor shall complete the revised compliance form and provide in-progress photos with identifiable traits or landmarks of the property showing the following:

1. Installation of tape or self-adhered membrane.
2. Fastening of underlayment.
3. Fastening of drip edge metal over underlayment.
4. Application of flashing cement or approved alternate means of attachment along roof edges, intersections and valleys.
5. Installation of approved starter strips at eaves.

The Evaluator shall verify that shingles along the edges of the roof do not overhang more than ¼ in. beyond the drip edge metal.
Steep-Slope Wood Sheathing Attachment

Technical Bulletin
FC 2018-01

First Release:
March 27, 2018

Prepared by:
Chuck Miccoli, Vice President, Commercial Lines
Christopher Cioffi, Commercial Lines Engineer

Applicable Standards:
FORTIFIED Commercial™–Hurricane
FORTIFIED Commercial™–High Wind & Hail

Applicable Designation Level:

Abstract
This document is intended to provide additional guidance for the attachment of structural sheathing roof deck to wood framing for steep-slope applications.

Introduction
The FORTIFIED Commercial™ program is dedicated to providing stronger, more resilient steep-slope roof systems. The attachment and assessment of the structural wood panel (oriented strand board [OSB] or plywood) roof sheathing shall follow the methods described in this document. The outlined requirements are based on the peak height (highest part) of the roof: 30 ft and below or above 30 ft.

The requirements in this bulletin are to be applied in conjunction with federal, state and local codes, ordinances and regulations. In case of a conflict between provisions, use whichever regulation is more stringent.

General Requirements

1. IBHS reserves the right to request additional calculations as deemed necessary to assess structural design.
2. This bulletin must be used in conjunction with the requirements of the FORTIFIED Commercial standards.
3. Roof sheathing shall be OSB or plywood with a minimum thickness of 7/16 in.
4. Roof zones shall be designated in accordance with ASCE 7.
5. Roof dimension “a” shall be calculated in accordance with ASCE 7.
Sheathing Fastening Requirements

Table 1 describes the fastening requirements for OSB and plywood sheathing on steep-sloped (>10°) wood framing members. Calculations for fasteners are not required for buildings with roof peak height less than 30 ft (see table 1 for peak height definition). Provide fastener information and spacing on the FORTIFIED Commercial Project Construction Form & Compliance Checklist.

Table 1: Sheathing Fastening

<table>
<thead>
<tr>
<th>Roof Peak Height</th>
<th>Max Roof Member Spacing</th>
<th>Sheathing Thickness</th>
<th>Fastener Type</th>
<th>Fastener Spacing Along Structural Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>H ≤ 30 ft</td>
<td>24 in. o.c.</td>
<td>7/16–5/8 in.</td>
<td>8d ring shank nails</td>
<td>6 in. 6 in. 4 in.</td>
</tr>
<tr>
<td>H &gt; 30 ft</td>
<td>24 in. o.c.</td>
<td>&gt; 5/8 in.</td>
<td>10d ring shank nails</td>
<td>6 in. 6 in. 4 in.</td>
</tr>
</tbody>
</table>

A. Roof Peak Height refers to the dimension of the tallest part of the roof from grade.

B. All fasteners shall be ring shank nails or screws unless otherwise noted and approved by IBHS.

C. For roof peak height less than or equal to 30 ft, gable ends shall be treated as a corner condition with dimension “a” from the edge. See figure 1.

D. Provide calculations of the sheathing and fasteners for uplift and lateral loads (diaphragm action).
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Prepared by:
Chuck Miccolis, Vice President,
Commercial Lines
Christopher Cioffi, Commercial Lines
Engineer

Applicable Standards:
FORTIFIED Commercial™–Hurricane
FORTIFIED Commercial™–High Wind
& Hail

Applicable Designation Level:

Figure 1: Roof Zones for Gable and Hip Roofs (H ≤ 30 ft)
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Christopher Cioffi, Commercial Lines Engineer

Applicable Standards:
FORTIFIED Commercial™–Hurricane
FORTIFIED Commercial™–High Wind & Hail

Applicable Designation Level:

Additional Approved Roofing Systems

Abstract
This technical bulletin is intended to provide additional guidance and options for low-sloped roofing systems.

Introduction
The FORTIFIED Commercial™ program is dedicated to providing stronger, more resilient roof cover systems that are tested and approved, and provide a known performance expectation against high winds. FORTIFIED Commercial standards now include low-sloped roof cover systems approved by the Texas Department of Insurance (TDI); ICC Evaluation Service (ICC-ES); and Florida Product Approval (FPA).

- TDI [www.tdi.texas.gov/wind/prod/indexrc.html]
- ICC-ES [www.icc-es.org]
- FPA [www.floridabuilding.org/pr/pr_app_srch.aspx]

This technical bulletin is to be used as an addition to section 3.1.2.1 Low-sloped continuous roof covers of the FORTIFIED Commercial standards.
Low-Sloped Roofing Systems

TDI-Approved Roof Covers

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 of the FORTIFIED Commercial standards.

- TDI Options
  - Multiple Systems: Select separate TDI-approved systems rated for each area: field, perimeter, and the corner.
  - Single System: Select a TDI-approved system rated for the corner area uplift pressures and use it for the entire roof.
  - Note: TDI does not permit edge (perimeter/corner) enhancements.

Please refer to the roof selection example from section 3.1.2.1 of the FORTIFIED Commercial standards. TDI-approved systems follow the same premise as Miami-Dade systems for multiple and single systems. Please note, TDI does not permit edge enhancements.

Verification and Documentation
The design team shall document the following information regarding all current and active TDI-approved roof systems on the Project Construction Form & Compliance Checklist.

1. Location (Field/Perimeter/Corner)
2. TDI Evaluation ID (RC-xxx)
3. Assembly number
4. Design pressure range
5. All materials and securement details

The design team must also submit a copy of the TDI Product Evaluation Report for each approved system to the FORTIFIED Evaluator.
Low-Sloped Roofing Systems

ICC-ES–Approved Roof Covers

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 of the FORTIFIED Commercial standards.

- ICC-ES Roof Cover Options
  - Multiple Systems: Select separate ICC-ES–approved systems rated for each area: field, perimeter, and the corner.
  - Single System: Select a ICC-ES–approved system rated for the corner area uplift pressures and use it for the entire roof.

Please refer to the roof selection example from section 3.1.2.1 of the FORTIFIED Commercial standards. ICC-ES–approved systems follow the same premise as Miami-Dade systems for multiple and single systems. Please note, ICC-ES does not permit edge enhancements.

Verification and Documentation

The design team shall document the following information regarding all current and active ICC-ES–approved roof systems on the Project Construction Form & Compliance Checklist.

1. Location (Field/Perimeter/Corner)
2. ESR report number
3. Division number
4. Section number
5. Table and system number
6. Allowable wind uplift
7. All material and securement details

The design team must also submit a copy of the ICC-ES Report for each approved system to the FORTIFIED Evaluator.
Low-Sloped Roofing Systems

FORTIFIED Commercial™—Hurricane
FORTIFIED Commercial™—High Wind & Hail

FPA-Approved Roof Covers

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 of the FORTIFIED Commercial standards.

- FPA Roof Cover Options
  - Multiple Systems: Select separate FPA-approved systems rated for each area: field, perimeter, and the corner.
  - Single System: Select an FPA-approved system rated for the corner area uplift pressures and use it for the entire roof.

Please refer to the roof selection example from section 3.1.2.1 of the FORTIFIED Commercial standards. FPA-approved systems follow the same premise as Miami-Dade systems for multiple and single systems. Please note, in some instances, FPA does permit edge enhancements that follow the provisions stated in the corresponding active FPA Evaluation Report.

Verification and Documentation
The design team shall document the following information regarding all current and active FPA-approved roof systems on the Project Construction Form & Compliance Checklist.

1. Location (Field/Perimeter/Corners)
2. FL number
3. Design pressure
4. All material and securement details
5. Perimeter and corner enhancements
6. Enhancements calculations

The design team must also submit a copy of the FPA Evaluation Report for each approved system to the FORTIFIED Evaluator.