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INSURANCE INSTITUTE FOR BUSINESS & HOME SAFETY

TEXAS COMMERCIAL ROOFS

BEST PRACTICES GUIDE

Use this guidance to improve the long-term performance of your roof.

In the spring of 2016, severe storms ripped through Texas, substantially damaging more than 10,000 roofs. The roof is a commercial building's first line of defense from natural hazards such as wind, rain, fire, hail, ice, snow and extreme heat. The roof is also the most vulnerable part of every building. Extreme weather events will continue to hit Texas every year, and if your roof is compromised during one of those storms, it could sustain costly damage requiring repairs or even replacement. This guide provides best practices for commercial buildings to resist damage to roofs from thunderstorms, winds at the edges of tornadoes, hail events, hurricanes and other high-wind events.

Both low-sloped and steep-sloped roofs are addressed, and recommendations are provided for roof covers, roof-mounted equipment, photovoltaic systems, skylights, roof designs, sealing roof decks to prevent water intrusion, and other roof-related topics designed to help reduce potential damage. Approved products provide a known performance, so IBHS recommends the use of products that have been tested and approved by a certified testing facility. Product approvals in Texas can be found at www.tdi.texas.gov/wind/prod/index.html.

Also included in this guide is information about selecting a qualified roofing contractor. Proper installation directly impacts a roof's long-term performance so it is important to choose the right contractor. Take the time to check the contractor's references and their insurance coverage for general liability insurance or professional liability insurance, and talk to the contractor about your expectations.

Roofing the Right Way

Implementing the recommendations in this guide when building, replacing, repairing or retrofitting a commercial roof will make the building a more resilient and durable asset by improving the long-term performance of your roof during severe weather events.

HAIL

ROOF COVERS

Impact-Resistance Standards Background

UL 2218 is a test standard developed by Underwriters Laboratories for assessing the impact resistance of flexible roofing products. Testing involves dropping steel balls of varying sizes from heights designed to simulate the energy of falling hailstones. Class 4 indicates the product was still functional after being struck twice in the same spot by 2-in. steel balls. Note: This standard is appropriate for flexible roofing products like asphalt shingles, and metal panels or metal shingles. Class 4 rated products should be used.

It should be noted that while impact-resistant metal roofs have good impact resistance and are likely to survive hailstones without functional damage, metal roofs can be vulnerable to aesthetic damage since hail can cause permanent indentations in the roofing panels. Use of metal roofing products with granular coatings may reduce the visibility of small indentations.

FM 4473 is a test standard administered by FM Approvals and is a test that is similar to UL 2218, but instead of using steel balls, frozen ice balls are used. The FM 4473 test standard is used on rigid roof covering materials (like concrete tile, clay tile, or slate) and involves firing the ice balls from a sling or air cannon at the roof-covering product. A Class 3 rating indicates the product was still functional after being struck twice in the same spot by a 1¾-in. ice ball; a Class 4 rating requires the product to still be functional following 2 impacts in the same spot with 2-in. ice balls. Clay and concrete roof tiles should meet either a Class 3 or Class 4 impact rating. Class 4 rated products are preferred.

FM 4470 is an all-encompassing approval standard for low-slope roof assemblies (roof cover, insulation, and deck) and includes multiple test and performance requirements including hail damage resistance, exterior/interior combustibility, wind uplift, and other requirements. This minimum hail damage resistance is Moderate Hail (MH) resistance. IBHS recommends a hail damage resistance of Severe Hail (SH) for hail-prone areas.

Hail-resistant roof covers located in hail-prone areas should meet one of the following standards:

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

- FM Approvals Standard 4470 with a Class 1-SH
- UL 2218 Class 4

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

- UL 2218 Class 4
- FM Approvals Standard 4473 Class 3 or Class 4 (Class 4 is preferred)

ROOF-MOUNTED EQUIPMENT

Hail guards should be provided for air conditioner condenser fins, air intakes such as fans, and any other vulnerable component that, if struck by hail, can impair the operation of the unit.

PHOTOVOLTAIC SYSTEMS

For photovoltaic (PV) system hail protection the following is recommended:

- Rigid PV modules that are FM Approved for hail or meet FM Approvals Standard 4478 that include a Class 4 rating.
- Flexible PV modules that are FM Approved for hail or meet FM Approvals Standard 4476 that include a Severe Hail rating.
- Rigid modules that meet UL 1703 Flat-Plate Photovoltaic Modules and Panels.

SKYLIGHTS

For protection against hail, skylights should meet at a minimum ASTM E1886 cyclic pressure test requirements and ASTM E1996 large missile impact-rated. Impact-resistant skylights can be found in the Texas Department of Insurance Product Evaluation Index.

LOW-SLOPED ROOF DESIGN FOR GREATER WIND RESISTANCE

- Flat and low-sloped roof cover systems such as built-up roof, modified bitumen, single-ply, and structural metal panel roof systems should be designed using a 2.0 safety factor based on the appropriate wind pressures of ASCE 7 (American Society of Civil Engineers) "Minimum Design Loads for Buildings and Other Structures" for the field, perimeter, and corners. Roof cover systems should be listed in the Texas Department of Insurance "Product Evaluation Index."
- Ballasted single-ply roof covers are not recommended to be installed in hurricane-prone areas. For ballasted low-sloped roof systems in non-hurricane-prone areas, the system should be installed in accordance with ANSI/SPRI RP-4.
- Edge flashing, coping, and counter flashing should comply with ANSI/SPRI/ES-1.
- Skylights and their curb attachment should also be designed using a 2.0 safety factor based on the appropriate wind pressures of ASCE 7.
- Roof-mounted equipment, and their attachments on low- to mid-rise buildings should be designed in accordance with ASCE 7-10 Section 29.5.1 "Rooftop Structures and Equipment for Buildings with h ≤ 60 ft." and Equations 29.5-2 and 29.5-3.
- Roof-mounted ballasted photovoltaic (PV) systems are not recommended in hurricane-prone areas. However, if ballasted systems are selected, they should be designed using a 2.0 safety factor as described for structurally attached systems. Structurally attached PV systems and their attachments should be designed using a 2.0 safety factor based on the 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. The roof deck should be designed to support the increased PV array loads, including live loads such as rain.

STEEP-SLOPED WOOD DECK ROOF DESIGN FOR GREATER WIND RESISTANCE

Re-Nailing a Wood Roof Deck

IBHS research has found that the use of staples and minimum size nails allowed in older building codes, regardless of the spacing, are inadequate to keep a roof from lifting up in high winds. This is particularly true along trusses and rafters in the middle of the roof sheathing panels, where it has been common practice to space fasteners 12 in. apart. When an old roof cover and underlayment is torn off, it's easy to inspect the existing fasteners and to install additional nails to strengthen the roof deck attachment. IBHS recommends installing ring shank nails, if additional nails are required to strengthen the roof deck attachment.

Generally, if nails fastening the roof deck to the roof framing below are smaller than 8d common nails or if staples were used, 8d ring shank nails should be added at 6 in. o.c.

If the size of the existing nails is at least 8d commons, the distance between nail spacing should not exceed 6 in. o.c. If it does, 8d ring shank nails should be added to reduce the nail spacing so the distance between the existing nails and the additional nails is no more than 6 in., unless engineering analysis or local code requires more fasteners at the corners.

Sealing the Roof Deck Against Water Intrusion

The roof deck should be "sealed" to prevent water intrusion. Typical felt underlayment is not sufficient. The following options provide more specific information on underlayment systems that "seal the roof deck."

Option 1

Tape roof seams between roof sheathing. There are two material options for taping the seams on the roof deck.

- Option 1: Apply an ASTM 1970 compliant self-adhering polymer-modified bitumen flashing tape, at least 4 in. wide, directly to the roof deck to seal the horizontal and vertical joints in the roof deck.
- Option 2: Apply 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, directly to the roof deck to seal the horizontal and vertical joints in the roof deck.
- All flashing tape used to achieve a sealed roof deck should be fully adhered without voids (e.g., wrinkles). Do not nail or staple the tape to the roof sheathing. Refer to the manufacturer's requirements for installation as some tapes may require installation over primer. Next, apply a code-compliant #30 ASTM D226 Type II underlayment over the self-adhering tape. This underlayment should be attached using annular ring or deformed shank roofing fasteners with minimum 1-in.-diameter caps (button cap nails) at 6 in. o.c. spacing along all laps and at 12 in. o.c. in the field or a more stringent fastener

schedule if required by the manufacturer for high-wind installations. Horizontal laps should be a minimum of 2 in. and end laps should be a minimum of 6 in.

Option 2

- Cover the entire roof deck with a full layer of self-adhering polymer-modified bitumen membrane meeting ASTM D1970 requirements. Cover the membrane with a layer of #15 ASTM D226 Type I underlayment over the fully adhered membrane as a bond break when the roof cover is asphalt shingles.

Option 3

- Apply a reinforced synthetic roof underlayment which has an ICC approval as an alternate to ASTM D226 Type II felt paper. The synthetic underlayment should have minimum tear strength of 20 lb per ASTM D5034 or ASTM D4533. This underlayment should be attached using annular ring or deformed shank roofing fasteners with minimum 1-in.-diameter caps (button cap nails) at 6 in. o.c. spacing along all laps and at 12 in. o.c. in the field or a more stringent fastener schedule if required by the manufacturer for high-wind installations and prolonged exposure. Horizontal laps should be a minimum of 2 in. and end laps shall be 6 in. and all laps should be sealed with a compatible tape or mastic. If horizontal laps are increased to 19 in., they do not need to be sealed with tape or mastic. All vertical seams need to be appropriately sealed.

Option 4

- Install two (2) layers of ASTM D 226 Type II (#30) or ASTM D 4869 Type IV (#30) underlayment in a shingle-fashion, lapped 19 in. on horizontal seams (36-in. roll), and 6 in. on vertical seams. Fasten underlayment at approximately 6 in. o.c. along the laps and at approximately 12 in. o.c. in the field of the sheet between the side laps. Secure underlayment using annular ring or deformed shank nails with 1-in.-diameter caps (button cap nails).

Choosing and Installing High Wind–Rated Shingles

The ASTM shingle testing standards and classification system, not the advertised warranty period and warranty wind speed for the shingles, will determine which shingles are best suited for the wind speeds in your area.

For optimal protection from high wind, choose shingles that have an ASTM D7158 Class H or ASTM D3161 Class F wind rating. For improved hail protection, select a product that has a UL 2218 or FM 4473 Class 4 impact rating. Note: If you live in a wildfire-prone area, make sure the shingles also include a UL or ASTM Class A fire rating. Asphalt shingles, along with tile and metal roof coverings, are widely available with a Class A fire rating.

Shingles should be installed in accordance with the manufacturer's instructions for high-wind installation, using the number of nails in the locations required by the manufacturer for high-wind fastening. In areas where the local building code requires more fasteners than are required by the manufacturer, fasteners should comply with the local building code.

CLAY AND CONCRETE ROOF TILES WIND RESISTANCE REQUIREMENT

Clay and concrete roof tile systems and their attachment must meet the requirements for the site design wind speed and exposure category. Clay and concrete roof tiles must be installed in accordance with FRSA/Tile Roofing Institute installation guidelines, "Concrete and Clay Roof Tile Installation Manual Fifth Edition Revised," for the site design wind speed and exposure. For high-wind consideration, a minimum 110 mph V_{asd}/140 mph V_{ult} is appropriate. Hip and ridge boards must be attached to the roof framing to resist the uplift pressure in accordance with the FRSA/TRI Manual using the appropriate site design wind speed or the 110 mph V_{asd}/140 V_{ult} minimum. Hip and ridge tiles must be secured to the hip and ridge boards with mechanical fasteners and/or an approved roof tile adhesive.

Note: FRSA/Tile Roofing Institute installation guidelines, "Concrete and Clay Roof Tile Installation Manual Fifth Edition, Revised," are available from the Tile Roofing Institute or the Florida Roofing, Sheet Metal and Air Conditioning Contractor's Association.

ARCHITECTURAL METAL PANELS WIND RESISTANCE REQUIREMENT

Metal panel roofing system and their attachment must be installed in accordance with the manufacturer's installation instructions and must provide uplift resistance equal to or greater than the design uplift pressure for the roof based on the site design wind speed and exposure. For high-wind consideration, a minimum 110 mph V_{asd}/140 mph V_{ult} is appropriate. The metal panels must be installed over continuous decking and one of the acceptable sealed roof deck underlayment options.

GUIDELINES FOR COMMERCIAL ROOFING IN WILDFIRE-PRONE AREAS

Texas is at high risk for wildfire with many commercial buildings located in what the fire service calls the Wildland Urban Interface (WUI), which can include suburban areas with designated conservation/preservation areas in and around the complexes. This type of land use planning can create increased exposure to wildfire, especially in typically dry and drought-stricken areas. While direct exposure to wildfire flames and radiant heat can be a source of ignition, burning embers associated with wildfires can travel significant distances and land on roofs or be blown into vents, resulting in ignition of the building.

To help prevent fire damage to your roof, you should first assess your roofing material to determine your risk. If necessary, consider replacing your roof using fire resistant roofing material.

COMMERCIAL ROOF COVER—EXTERNAL FIRE RATINGS

To address the level of roof cover protection provided against wildfire risks, fires from nearby buildings, and other external fire risks, roof covers are specifically rated as Class A, Class B, Class C, or unrated, based on testing to ASTM E-108, UL 790 or FM 4470 standards. A roof cover system rated Class A provides the best protection from wildfire or ember ignition, while an unrated roof is the most vulnerable.

- For low-sloped roofs, Class A roof cover systems typically include built-up, modified bitumen, single-ply membranes, stone ballasted, and various hybrid covers. These roof covers are rated based on the materials that make up the entire roof cover assembly.
- Common Class A roof coverings for steep-sloped roofs include asphalt fiberglass composition shingles and concrete or clay tiles. As with low-sloped roofs, some steep-sloped roof cover materials have a "by assembly" Class A fire rating, meaning additional materials should be used between the roof covering and the roof sheathing in order to attain the fire rating. Examples of steep-sloped roof coverings with a "by assembly" fire rating include aluminum, some fire-retardant wood shake products, and recycled plastic and rubber products.
- Unrated roofs include non-fire retardant treated wood shakes or shingles. If a building has a wood shake roof and there is no available documentation that specifies the fire rating, the owner should assume it is unrated, although this can be verified by a professional roof inspection.

When repairing or replacing a commercial roof in a wildfire-prone area, be sure to use Class A fire rated roof coverings. Also, be sure to check whether the rating is "by assembly," which means you will need additional materials between the roof covering and roof sheathing to attain the Class A fire rating.

How to Hire a Commercial Roofing Contractor

Hiring a commercial contractor can be a daunting task. Recognizing this challenge, IBHS recommends the list below to help business owners make informed decisions about choosing a dependable roof contractor with a track record for ethical business practices and quality work.

CONTINUING EDUCATION AND PROFESSIONAL CERTIFICATIONS

- Several organizations offer roofing contractors continuing education, expertise and information on the latest technologies and industry trends. Two widely known and reputable roofing associations are RCI, Inc. (RCI) (www.rci-online.org) and the National Roofing Contractors Association (NRCA) (www.nrca.net). While membership is not a seal of approval for participating companies, it does suggest that a roofing contractor has made an investment in learning and implementing best practices.
- Another way to enhance your quality control is to hire an RCI-certified third-party consultant to assist in selecting, managing, and/or observing reputable roof contractors. A consultant can help determine the needed repairs or roof replacement system, verify the materials are installed properly, and the installation meets the design requirements.
- Retaining a consultant adds expense but can be a valuable investment. For large, complicated jobs, it may be worth hiring a consultant, such as a Registered Building Envelope Consultant or Registered Roof Consultant, who can assist with the actual design and various logistics. Ensuring proper quality control and peace of mind may also be achieved by hiring a

Registered Roof Observer. More information about additional designations, qualifications, and exam requirements is available on the RCI website (www.rci-online.org).

BID SOLICITATION AND CONTRACTOR SELECTION

Once you have asked and answered the basic questions about potential contractors, you should solicit several bids before making a selection. Whether this is done through a formal RFP process or more informally, be sure to request the following information from all contractors:

- NRCA's Roofing Contractor Qualification Form 1.
- Supporting documents to demonstrate the contractor has a clear understanding of the purpose, services, scope, and objectives of the roof project, including:
  - Statement of Work, Legal Terms, and Conditions.
  - Project schedule to show duration of major activities, critical elements and milestones necessary to complete the work.
  - Detailed manufacturer specifications of the roof cover system to be installed, including testing information or nationally-recognized approvals that the system may have received, such as from Miami-Dade, Florida Product Approvals, Texas Department of Insurance, UL, FM Approvals, etc.
  - Site utilization diagram showing construction activities to be conducted within the property.
  - A plan describing strategies for addressing quality control, methodology for coordination of materials delivery, temporary storage, and installation.
  - A plan for bad weather that may alter the project schedule, along with an emergency plan for locations subject to severe weather during the installation period. This should include securing or removal of any loose materials on the site.
- Safety Concerns
  - Verification of a designated qualified safety representative who is charged with the responsibility of safety management for the project and will be on-site throughout the project.
  - Written safety plans for the work to be conducted, including compliance with all Occupational Safety & Health Administration (OSHA) requirements for roof work and fall protection.
  - Often times, roof cover systems may be installed or repaired using torch application. If not properly conducted, this can cause a fire hazard. It is recommended that a written hot work program should be implemented for any cutting, welding, torching, brazing or any introduction of a flame-involved process in order to protect against the significant risk of fires during installation. More information from IBHS about hot work precautions and programs can be found at DisasterSafety.org/ibhs/hot-work-dont-let-a-small-welding-job-result-in-major-damage.

Selection Process

While it is tempting to go with the lowest cost bid, all of the above considerations should be included in the decision process. When evaluating the bids, it is important for the business owner to have a clear understanding of the capabilities of the potential contractor, and the contractor needs to fully understand the parameters of the job. The key is to avoid any miscommunication that could lead to a roof system that does not meet expectations.

If possible, try to have major roof work done when the weather is appropriate for this type of activity. Roof work in hurricane-prone regions can be difficult during hurricane season, and in the northern part of the U.S., cold or snow can interfere with the installation process. Be aware that some roof cover systems require a certain temperature for proper installation, so the scheduling should account for expected and unexpected weather. Your contractor can provide more information.

UNDERSTANDING WARRANTIES

Warranties are typically available from the roof manufacturer and the installing contractor. Pay close attention to what the warranty does and does not include, particularly what is contained in the "Terms, Conditions, and Limitations" section, which may reference specific wind speeds, types of weather or "Acts of God."

Contractor Hiring Checklist

This checklist is intended to help you make informed decisions about choosing a dependable roofing contractor with a track record for ethical business practices and quality work.

- ✓ Look for a well-established roofing professional with a federal tax identification number and a permanent address.
- ✓ Check references that specifically include other commercial buildings in your area.
- ✓ Contact your local Better Business Bureau to check for complaints filed against the company.
- ✓ Ask to see the company's certificates of insurance. Make sure its coverage for liability and workers' compensation insurance is current.
- ✓ Discuss available material warranties from the manufacturer and installation warranties from the contractor.
- ✓ Check to see if the company is a member of a roofing industry organization that provides continuing education and up-to date information about roofing trends and developments.
- ✓ Obtain several bids for services.

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