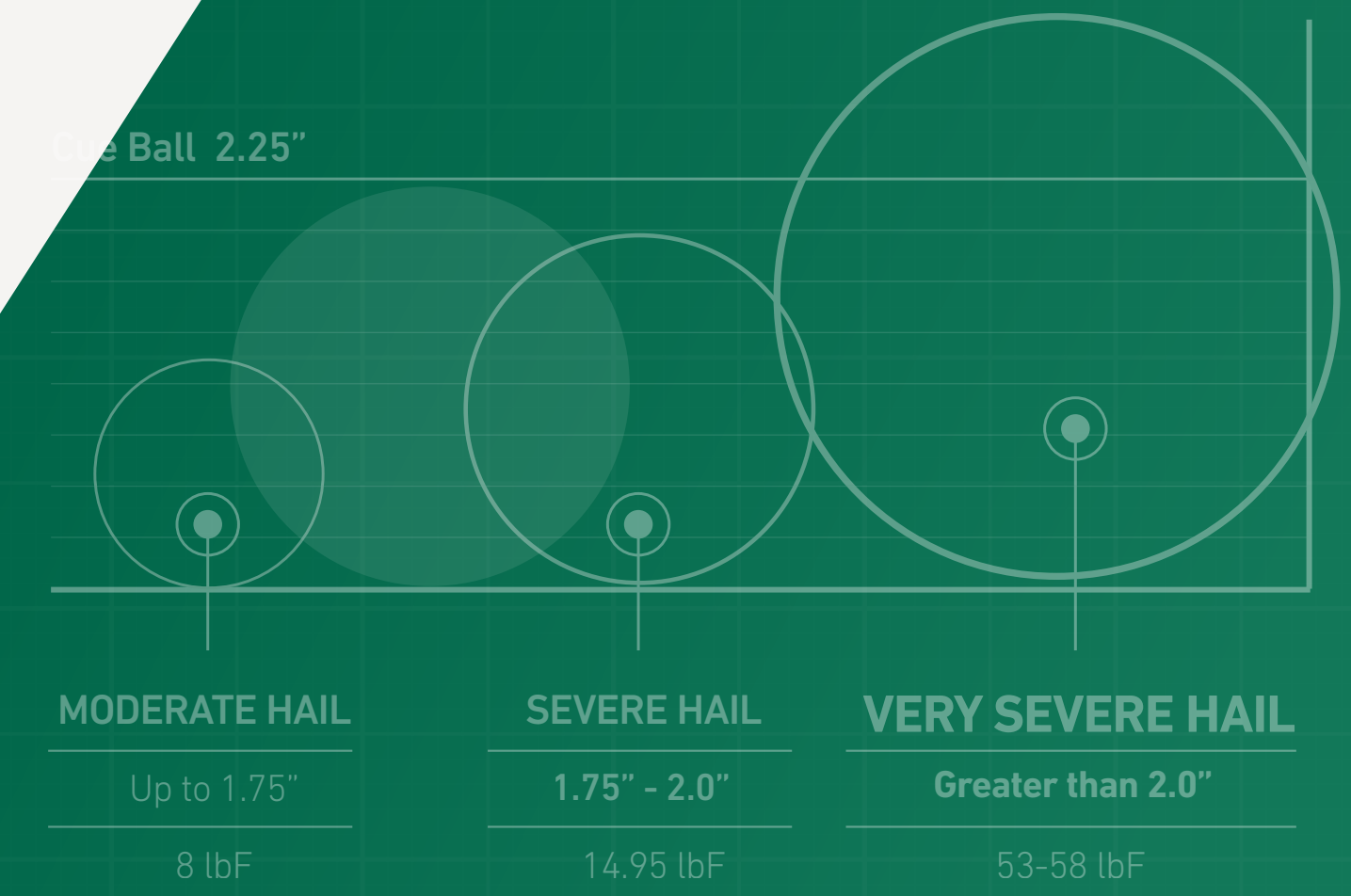
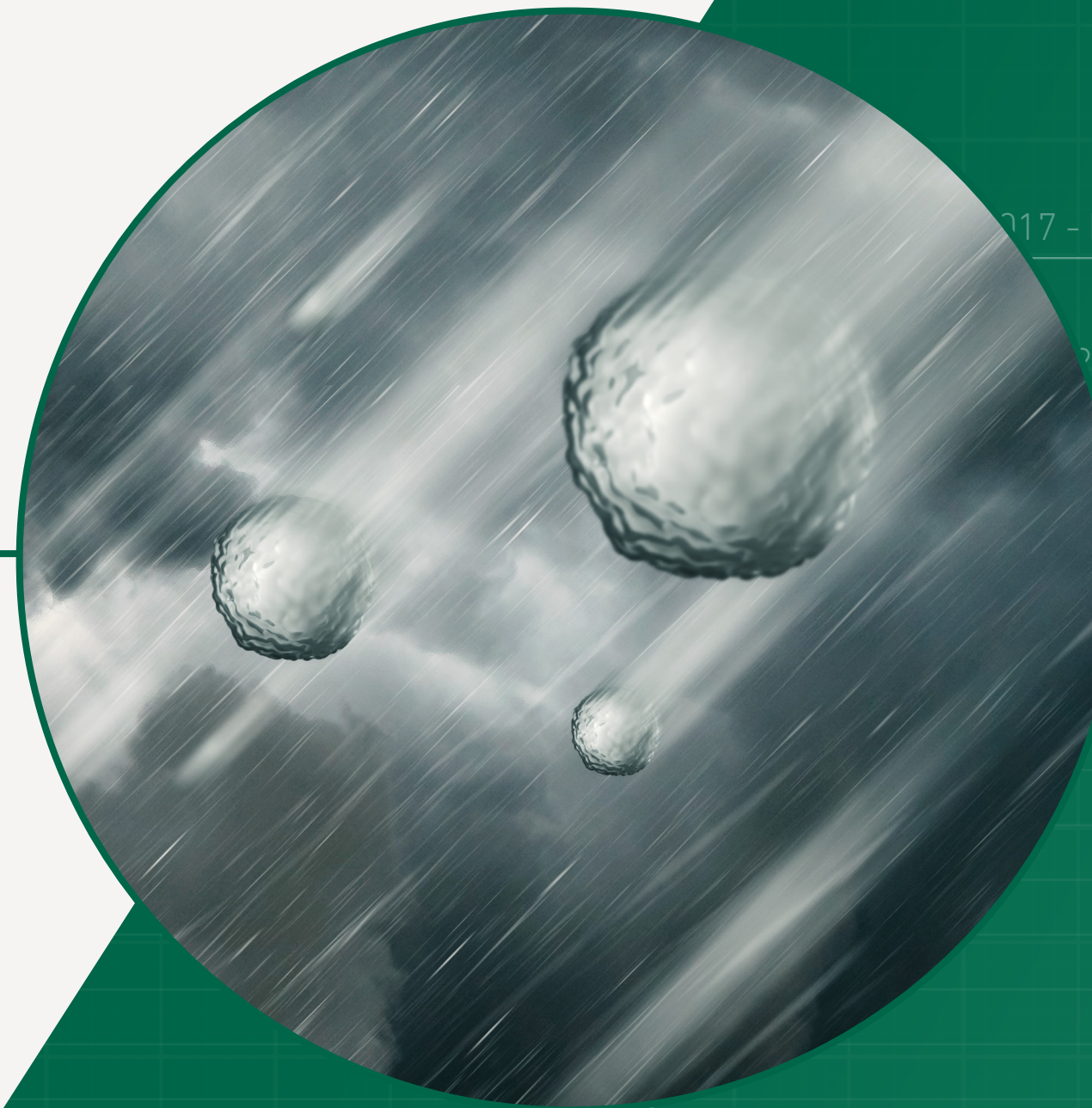


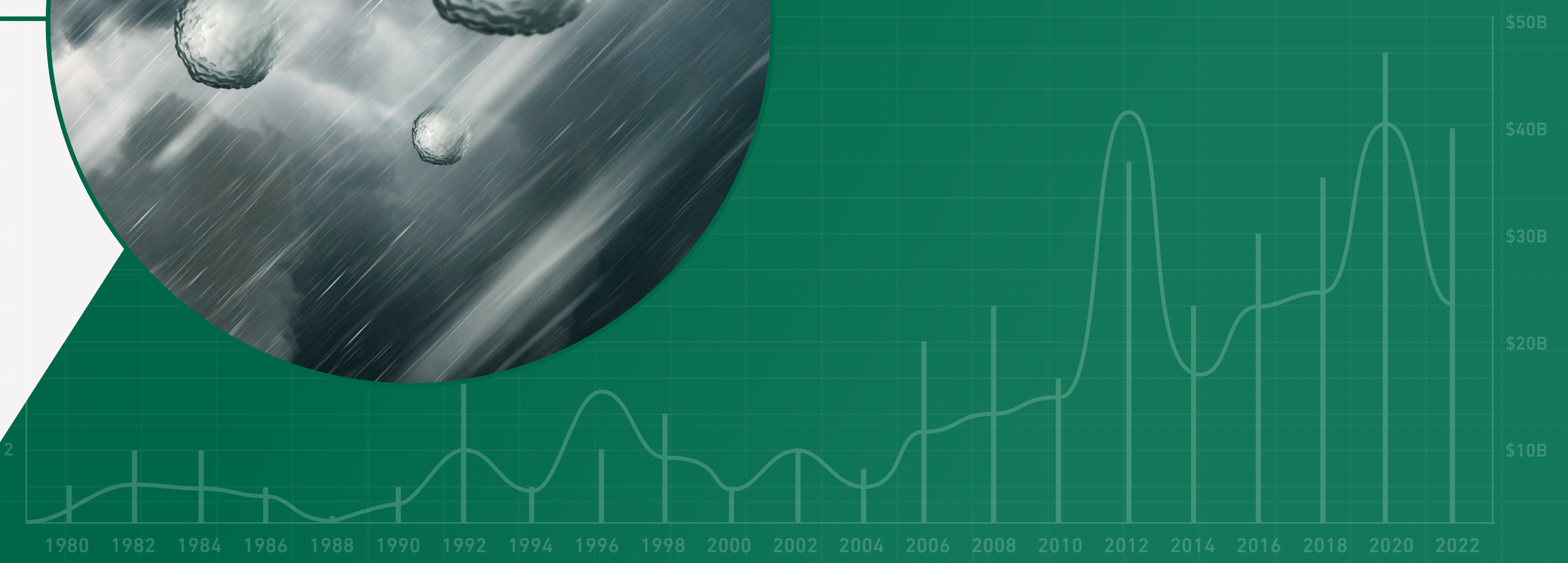
DESIGN FOR EXTREME WEATHER

WHY YOU SHOULD SPECIFY A RESILIENT ROOF SYSTEM

WHAT'S INSIDE:



2020 - Minnesota
2017 - Denver, Colorado
2012 - San Antonio, Texas



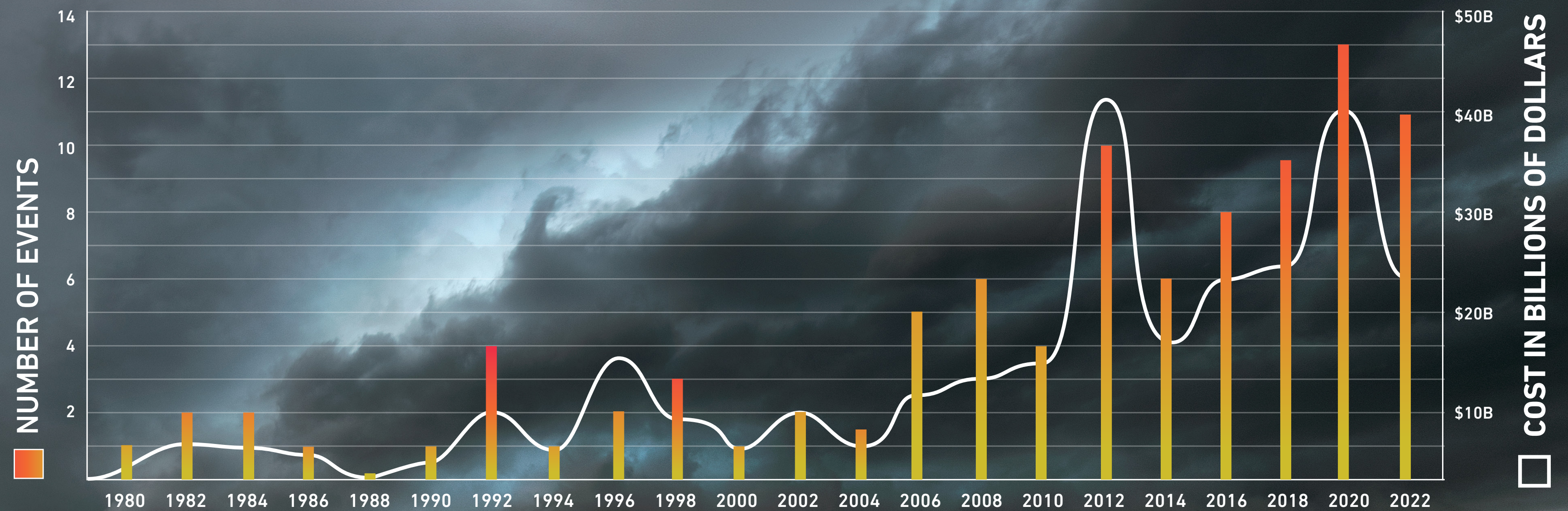
THE STEADY RISE OF SEVERE WEATHER

A region's climate influences the design and construction of building enclosures, especially roof assemblies. Due to the rising threat of severe weather events, it's more important than ever to specify materials that add strength and resiliency to your roofing systems.

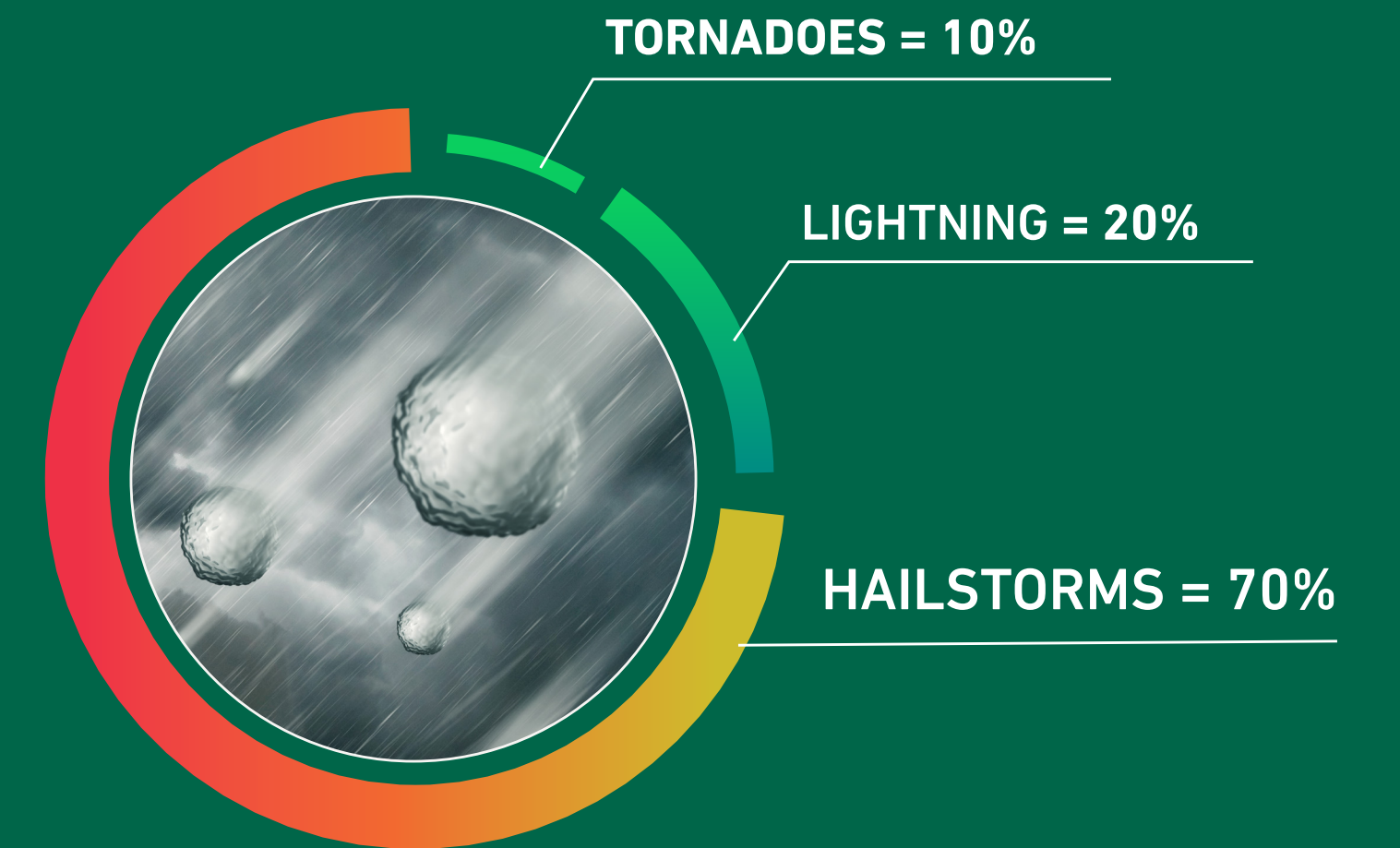
Catastrophic weather events—and the billions of dollars of damage they generate in the United States each year—have continued to increase in frequency and severity since 1980. Of all the types of billion-dollar disasters, severe storms are the most common. They include threats such as hail, lightning and severe winds that can cause devastating damage to roofing systems.

¹NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2023). <https://www.ncei.noaa.gov/access/billions/>, DOI: 10.25921/stkw-7w73

BILLION DOLLAR SEVERE STORM DISASTERS¹



The frequency of severe storm disasters is increasing faster than any other disaster type, with **70% of their average property losses attributed to hail.**¹



THE HIGH PRICE OF STORM DAMAGE

Hail can cause excessive damage to cars, homes and commercial buildings while also being deadly to livestock and people. **In 2022, insured losses related to hailstorms exceeded \$10 billion in the U.S. for the 15th consecutive year.**

Storm damage of this magnitude has become a frequent occurrence. Unfortunately, the threat of physical and monetary loss is all too real. That's why more and more third-party organizations are calling for designers and specifiers to implement resilient roof systems for commercial low-slope buildings.

²[https://www.ncei.noaa.gov/access/billions/events/US/2022?disasters\[\]=severe-storm](https://www.ncei.noaa.gov/access/billions/events/US/2022?disasters[]=severe-storm)



\$2.7 BILLION

A \$2.7B hailstorm hit Denver, Colorado, in 2017 with golf ball-sized hail. The storm forced a major shopping mall to close for six months after parts of the roof broke, allowing water to flood the mall.²



\$1.9 BILLION

The San Antonio metroplex and other cities in south Texas were hit with golf ball-sized hail in May 2020 that caused \$1.9B of damage to vehicles, residences and commercial businesses.²

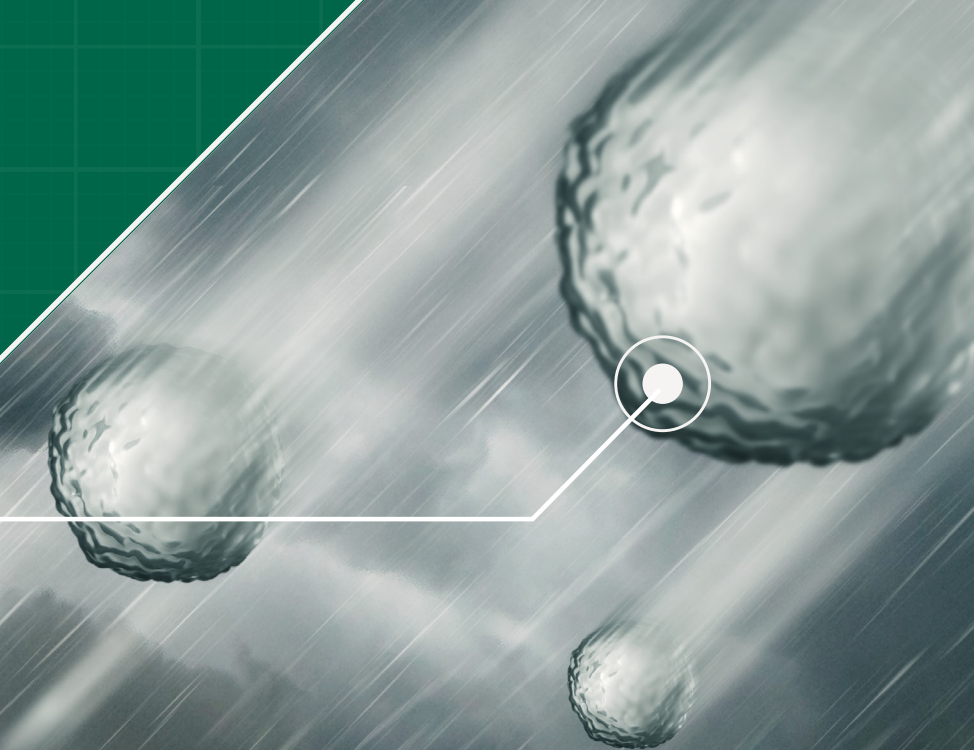


\$2.2 BILLION

Numerous hailstorms on May 9, 2022, caused \$2.2B of damage across south-central Minnesota. People reported hail the size of golf balls to baseballs damaging homes, vehicles, businesses and other infrastructure.²



Very Severe Hail can cause significant damage to entire neighborhoods. These examples show how hail has caused major devastation in recent years.



HOW ARE THE NATION AND ROOFING INDUSTRY REACTING?

Natural disasters have made other organizations plan for resilience.



FEMA, the Federal Emergency Management Agency, has set up hazard mitigation assistance grants like BRIC (Building Resilient Infrastructure and Communities) to support states, local communities, tribes and territories as they undertake hazard mitigation projects, reducing the risks they face from disasters and natural hazards.³



The Department of Homeland Security has also developed a Resilience Framework to help sustain its mission to provide support to essential functions in times of threats and disasters, as well as during normal operations.⁴



³<https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities>

⁴<https://www.dhs.gov/publication/dhs-resilience-framework>

⁵<https://www.nrca.net/RoofingNews/nrca-ceo-issues-statement-regarding-infrastructure-bill.8-12-2021.9805/details/story>

“We were pleased to work with our roofing industry allies to ensure the bill advances resiliency, energy efficiency and sustainability with new investments in airports, schools and other buildings vital to strong communities. **Roofs have a prominent role to play in protecting families and property** as the first line of defense against the elements.”⁵



Former NRCA CEO Reid Ribble of the National Roofing Contractor Association commending the U.S. Senate for approving the bipartisan Infrastructure Investment and Jobs Act.

WHO IS FM GLOBAL, AND WHAT IS VERY SEVERE HAIL (VSH)?

FM Global is a world-leading property insurance company. They specialize in loss prevention and property risk management services.

FM Approvals is an FM Global subsidiary that functions as an international third-party testing and verification service. FM Global recommends the use of FM-Approved products at all of its insured locations. Organizations insured with other providers also specify FM-Approved products.

An FM-Approved roof assembly undergoes rigorous testing as part of the FM 4470 standard.

The full list of testing includes:

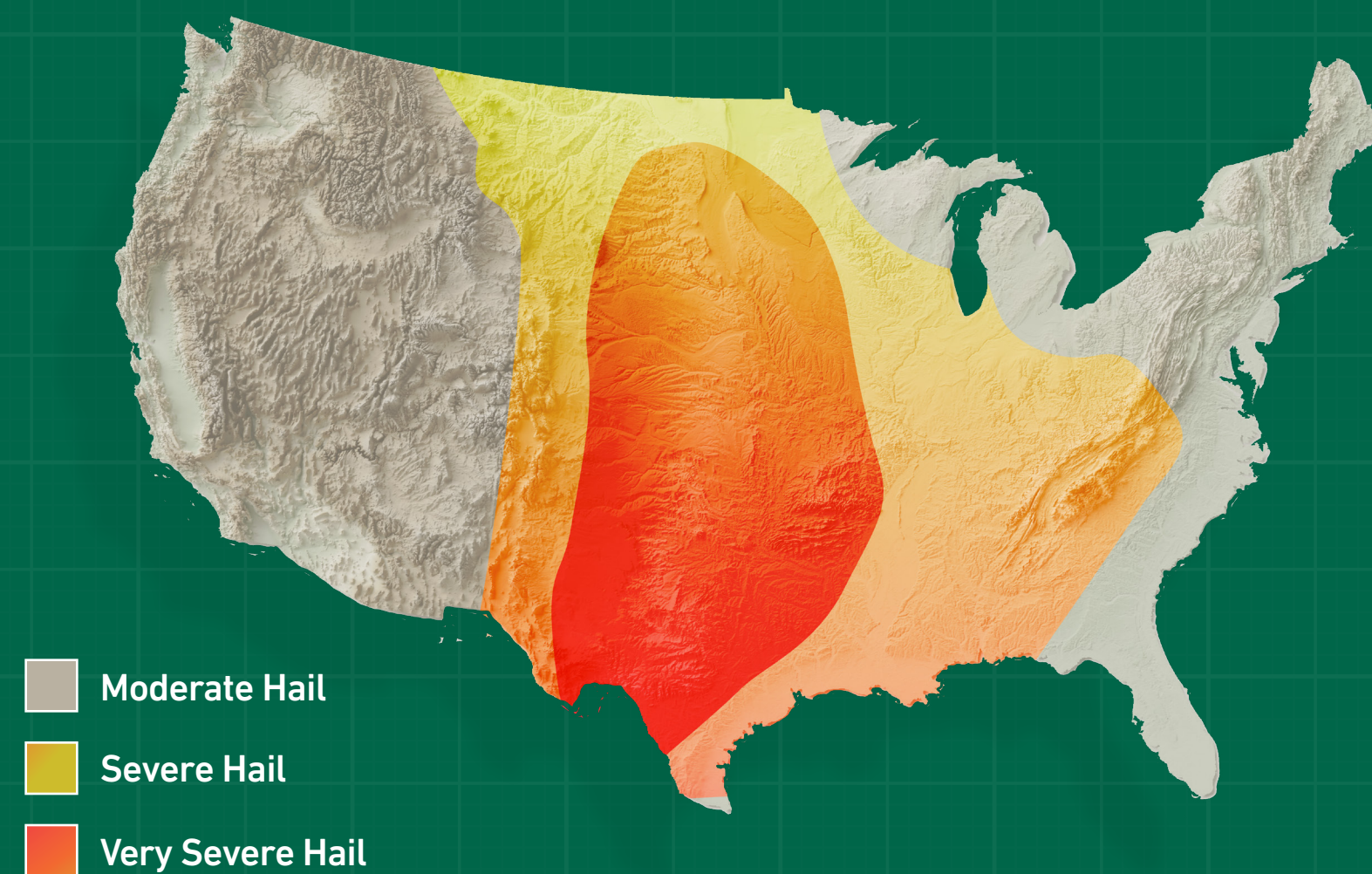
- Fire (internal and external)
- Wind uplift
- Water leakage
- Foot traffic resistance
- Hail damage
- Metal component corrosion resistance
- Puncture resistance

FM Approvals can offer a complete evaluation of a roof assembly, based on how it will perform against a wide range of potential threats. This helps give specifiers and insurers confidence the roof will perform as expected in a real-life scenario.

FM GLOBAL HAIL ZONES

Severe storm damage isn't limited to a few areas—FM Global-defined hail zones have widened in recent years.

Moderate Hail Zones have grown to reach a large part of the United States, while Severe and Very Severe Hail (VSH) Zones carve a path through the center of the country.



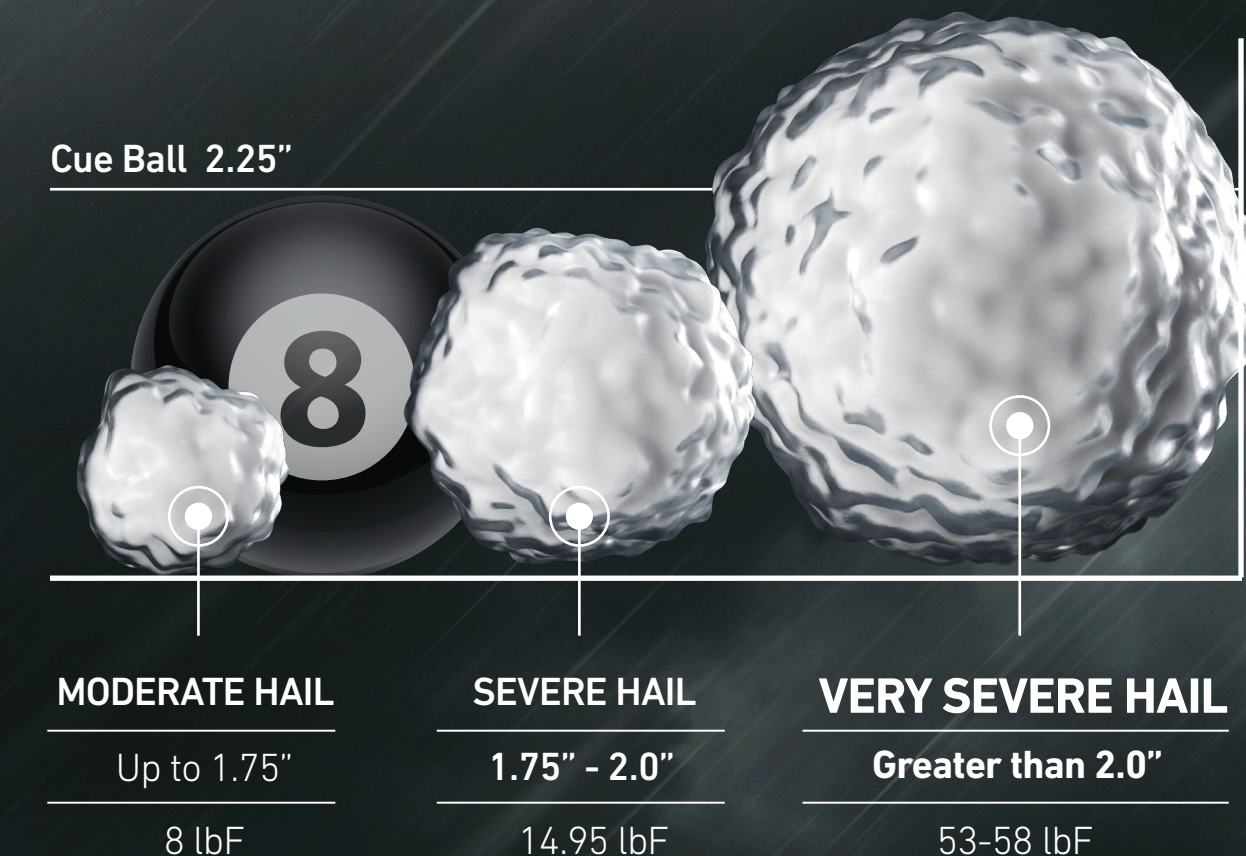
- Moderate Hail
- Severe Hail
- Very Severe Hail

STATES AFFECTED:

- | | | |
|-------------|-----------------|------------------|
| 1. Arkansas | 6. New Mexico | 11. Oklahoma |
| 2. Colorado | 7. North Dakota | 12. South Dakota |
| 3. Iowa | 8. Minnesota | 13. Texas |
| 4. Kansas | 9. Missouri | 14. Wyoming |
| 5. Nebraska | 10. Montana | |

FM-CLASSIFIED VERY SEVERE HAIL

FM Global categorizes hail severity according to size. Moderate hail is 1.75 inches in diameter or smaller, with severe hail growing up to 2 inches. VSH starts at 2 inches but may exceed 4 inches in diameter.



HAIL SPEED

As hailstones increase in size, they pick up speed. Very large hailstones can fall at over 100 mph. Multiply those speeding hailstones by hundreds, then thousands, and you can see how this kind of bombardment can bring about the billion-dollar damage shown in the data.⁶

HAIL DURATION

Hailstorms tend to be short, often only lasting minutes. However, that is plenty of time to create significant destruction. The most severe hailstorms may last up to 30 minutes.⁷

⁶NOAA National Centers for Environmental Information (NCEI) U.S. Billion-Dollar Weather and Climate Disasters (2023). <https://www.ncei.noaa.gov/access/billions/>, DOI: 10.25921/stkw-7w73

⁷<https://www.agcs.allianz.com/content/dam/onemarketing/agcs/agcs/pdfs-risk-advisory/checklists/ARC-Hailstorm-Checklist-EN.pdf>

SPECIFYING THE RIGHT MATERIALS FOR YOUR RESILIENT ROOF SYSTEM

Developing a resilient roof system means anticipating upcoming challenges to design beyond building code requirements. Instead of only taking historical problems into account, current (and future) unpredictability is factored in. This makes it necessary to use recent climate trends as a guide to design.

Durable roofs that can weather storms and other potential hazards have some important characteristics:

- ✓ Wind uplift resistance
- ✓ Impact/puncture resistance
- ✓ Fire resistance

BUILDING UP THE SYSTEM

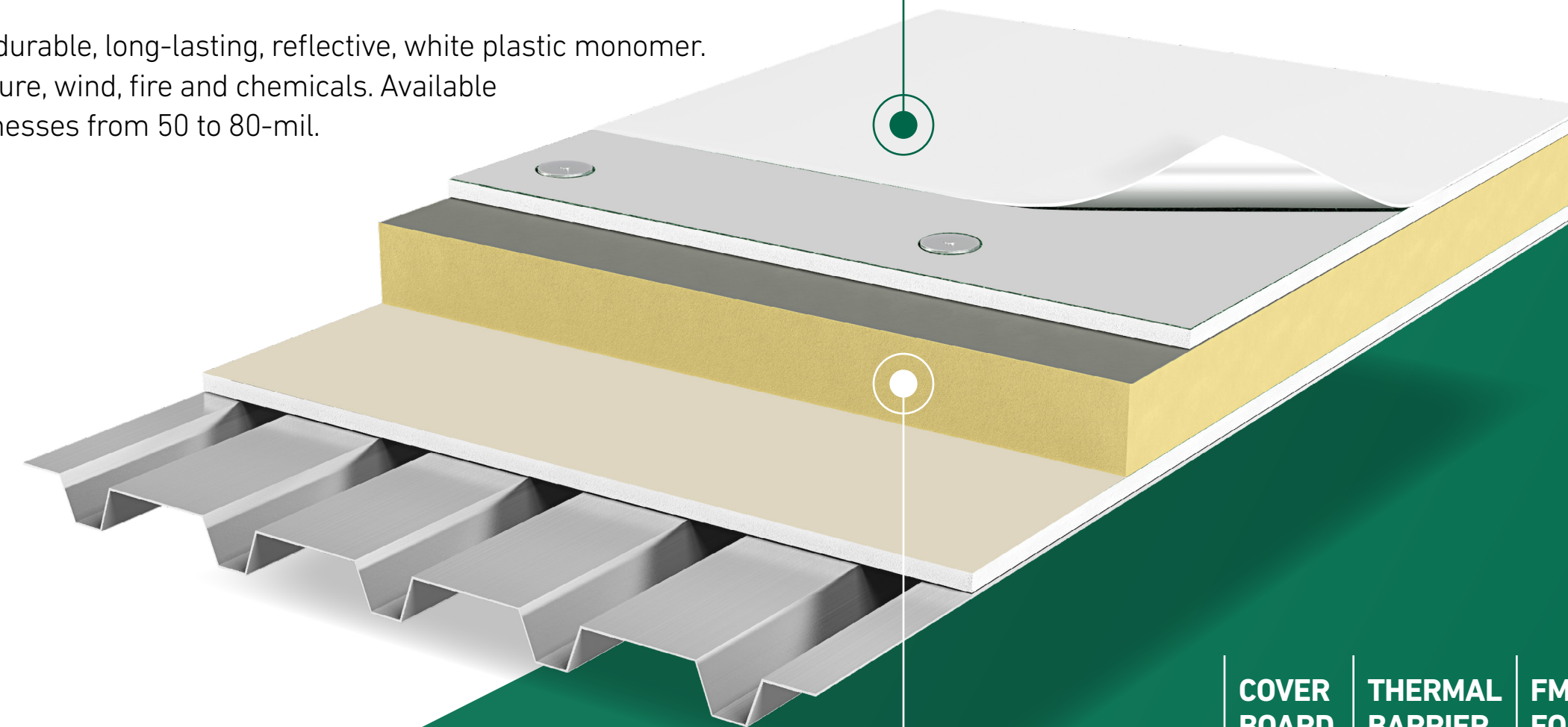
When choosing materials for a roof that can stand up to high winds, heavy rain and severe hail, start with a strong, **durable membrane**.

EPDM – (Ethylene Propylene Diene Terpolymer) a resilient, synthetic elastomer. Available in black and white, in a variety of widths and two thicknesses, 45 and 60-mil. It can be installed either fully adhered, mechanically attached or ballasted, with seams sealed by liquid adhesives or specially formulated tape.

TPO – (Thermoplastic Polyolefin) a reflective, white roofing material made primarily from recycled rubber. Can be fastened, attached or ballasted. Must be installed in dry conditions due to the heat adhesion seaming process. Material quality varies drastically among manufacturers, which may cause price variability.

PVC – (Polyvinyl Chloride) a durable, long-lasting, reflective, white plastic monomer. Flexible and resistant to moisture, wind, fire and chemicals. Available in a range of widths and thicknesses from 50 to 80-mil.

MOD Bit – (Modified Bitumen) a durable, flexible material made of asphalt combined with either polymerized rubber (SBS—styrene-butadiene-styrene) or plasticized polymers (APP—atactic polypropylene). It is then reinforced with fiberglass to create a waterproof membrane. Usually installed from rolls directly onto the substrate via an adhesive. The material may be heat-welded, cold-adhered, or in some cases, self-adhered or mechanically attached.



Roofs that can handle the impact of hail need a **cover board** to absorb it. There are several kinds available today.⁸

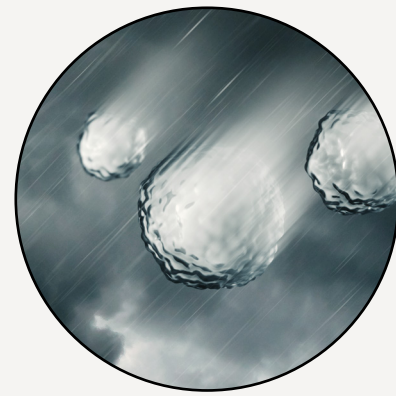
Cover boards have proven impact resistance, especially those approved by FM Global for VSH.

	COVER BOARD	THERMAL BARRIER	FM-CLASSIFIED FOR VSH	NONCOMBUSTIBLE (PER ASTM E136)	EASE OF USE (CAN USE UTILITY KNIFE)
OSB/PLYWOOD Wood	✓		✓		
HD ISO High-Density Foam Insulation	✓				✓
GYPSUM Fiberglass Mat Rigid Substrate	✓	✓	✓	✓	✓

⁸Consult RoofNav for FM-Approved and VSH assemblies with DensDeck® Prime and DensDeck® StormX™ Prime Roof Boards.

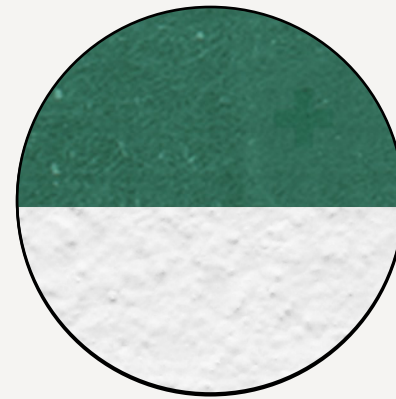
DENSDECK® STORMX™ PRIME ROOF BOARD: FOR SEVERE WEATHER EVENTS AND VERY SEVERE HAIL

Building on the legacy of DensDeck® Prime Roof Board, Georgia-Pacific pushes performance standards further.



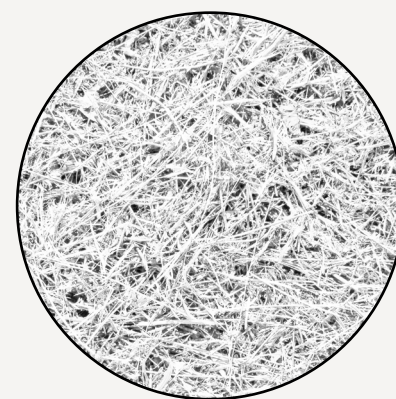
RIGID BOARD PROTECTION FOR MEMBRANE AND INSULATION

- Resists impact from repeat events such as maintenance foot traffic.
- Helps relieve static pressure caused by the weight of rooftop equipment.
- Helps defend against dynamic impact from flying debris.



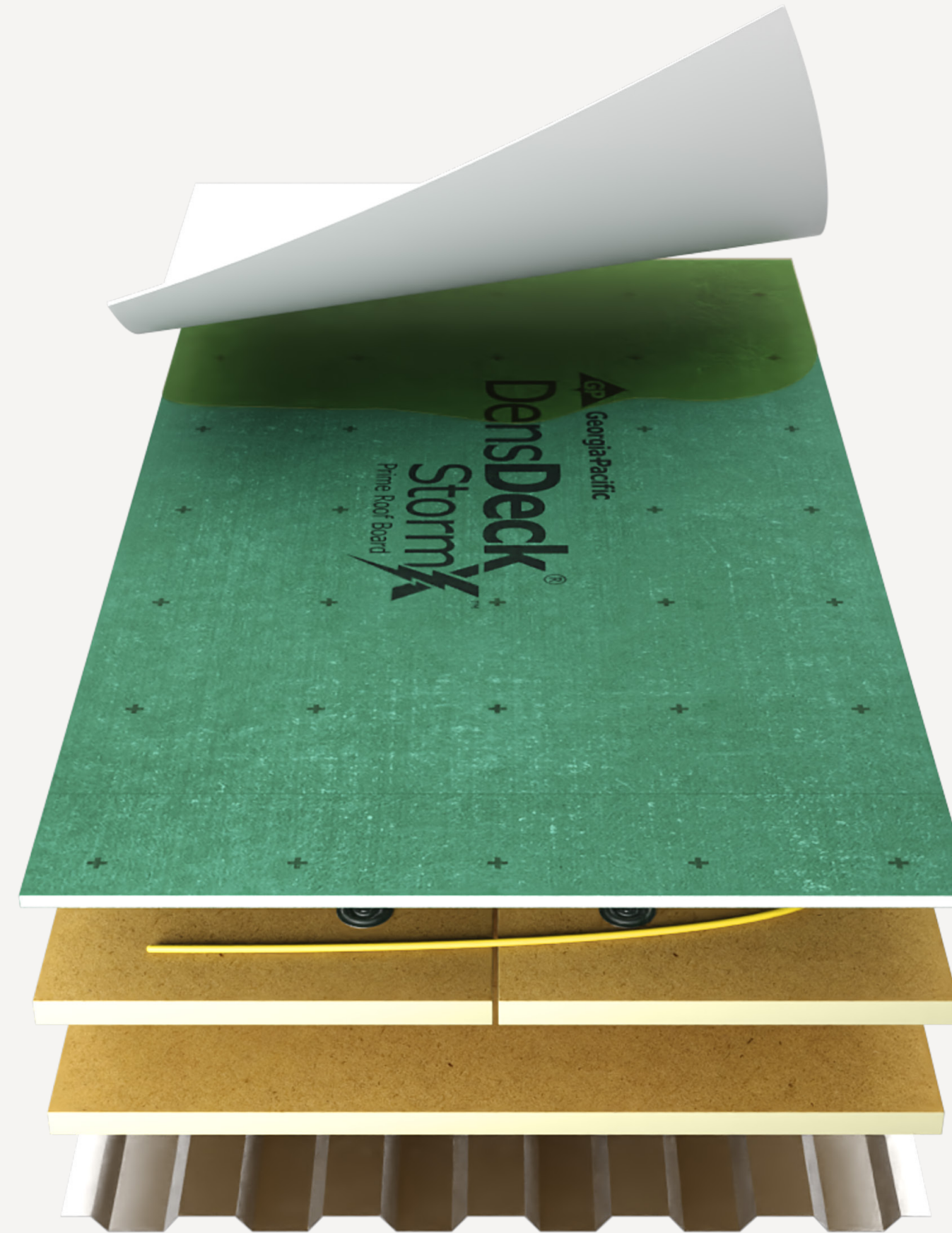
NONCOMBUSTIBLE GYPSUM CORE

- Zero flame and smoke spread when tested in accordance with ASTM E84 and CAN/ULC-S102.
- UL Classified for resistance to external fire sources [per ANSI/UL 790 and CAN/ULC-S114].
- UL Classified for resistance to fires below roof [per ANSI/UL 1256].



FIBERGLASS MAT REINFORCEMENT

DensDeck StormX Prime Roof Board helps protect against repeated hail strikes. It was the first gypsum cover board FM classified for VSH in approved single-ply assemblies.⁸

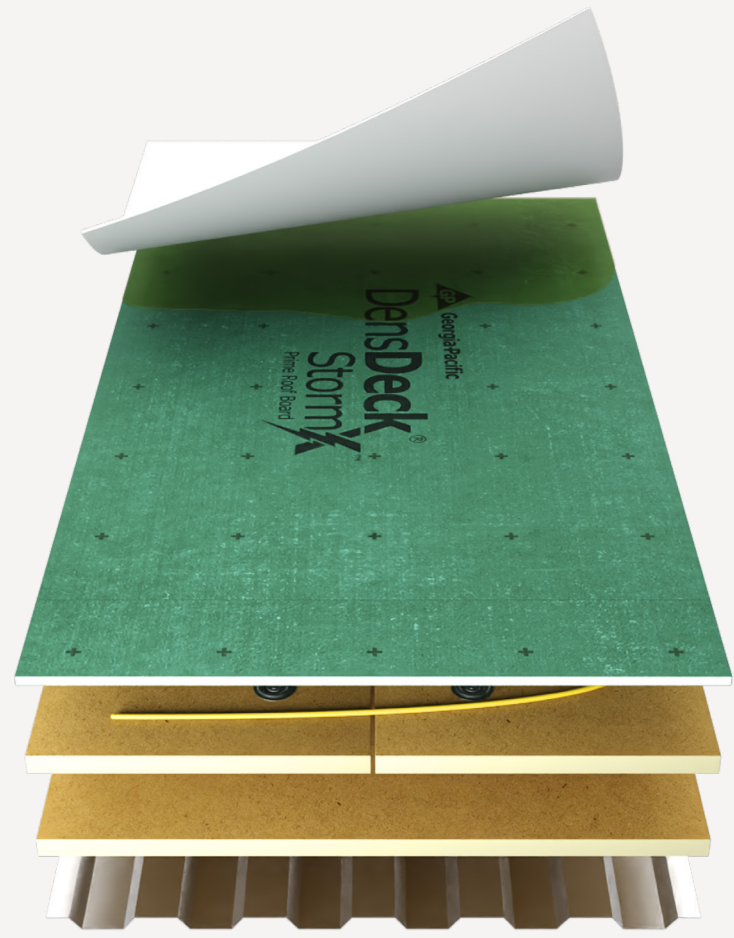


BOARD STRENGTH AND MAT-TO-CORE BOND

- Increases wind uplift resistance compared to DensDeck Prime Roof Board.
- Increases membrane bond strength compared to paper-faced gypsum.
- Improves fastener pull-through performance compared to paper-faced insulation or no cover board.
- Increases moisture resistance compared to DensDeck Prime Roof Board.

	DENSDECK® ROOF BOARD	DENSDECK® PRIME ROOF BOARD	DENSDECK® STORMX™ PRIME ROOF BOARD
COMPRESSIVE STRENGTH	900 PSI	900 PSI	1,800 PSI
FLEXURAL STRENGTH	100 FT-LBS	100 FT-LBS	200 FT-LBS
FLUTE-SPAN	8 INCHES	8 INCHES	18 INCHES

⁸Consult RoofNav for FM-Approved and VSH assemblies with DensDeck® Prime and DensDeck® StormX™ Prime Roof Boards.



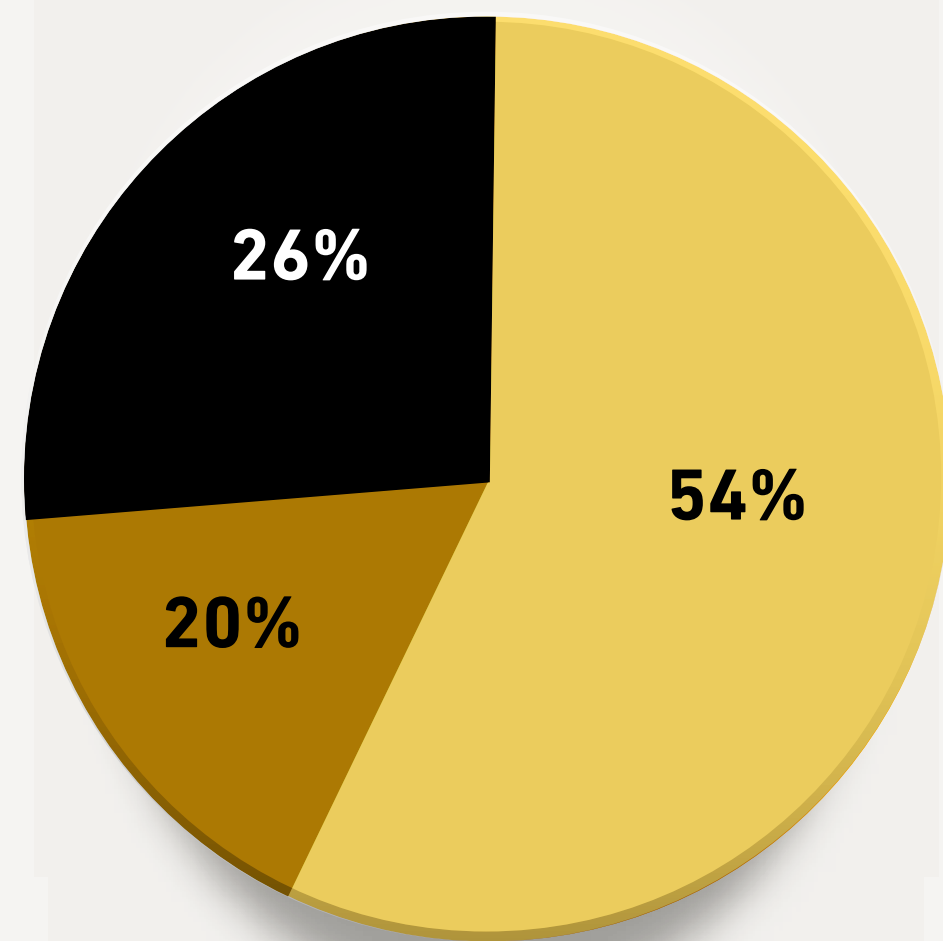
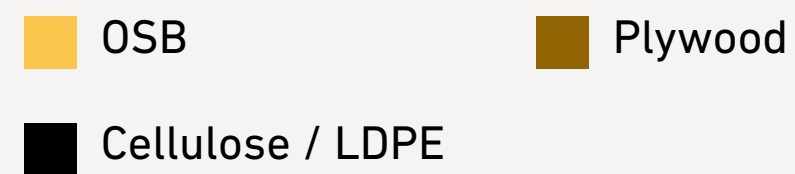
**DENSDECK® STORMX™
PRIME ROOF BOARD IS
APPROVED IN 83% OF
TOTAL FM GLOBAL VSH
SINGLE-PLY MEMBRANE
ASSEMBLIES.**

Of that 83%, DensDeck StormX Prime Roof Board is FM classified for VSH with most major system manufacturers.



**BEFORE DENSDECK STORMX PRIME
ROOF BOARD WAS FM-CLASSIFIED**

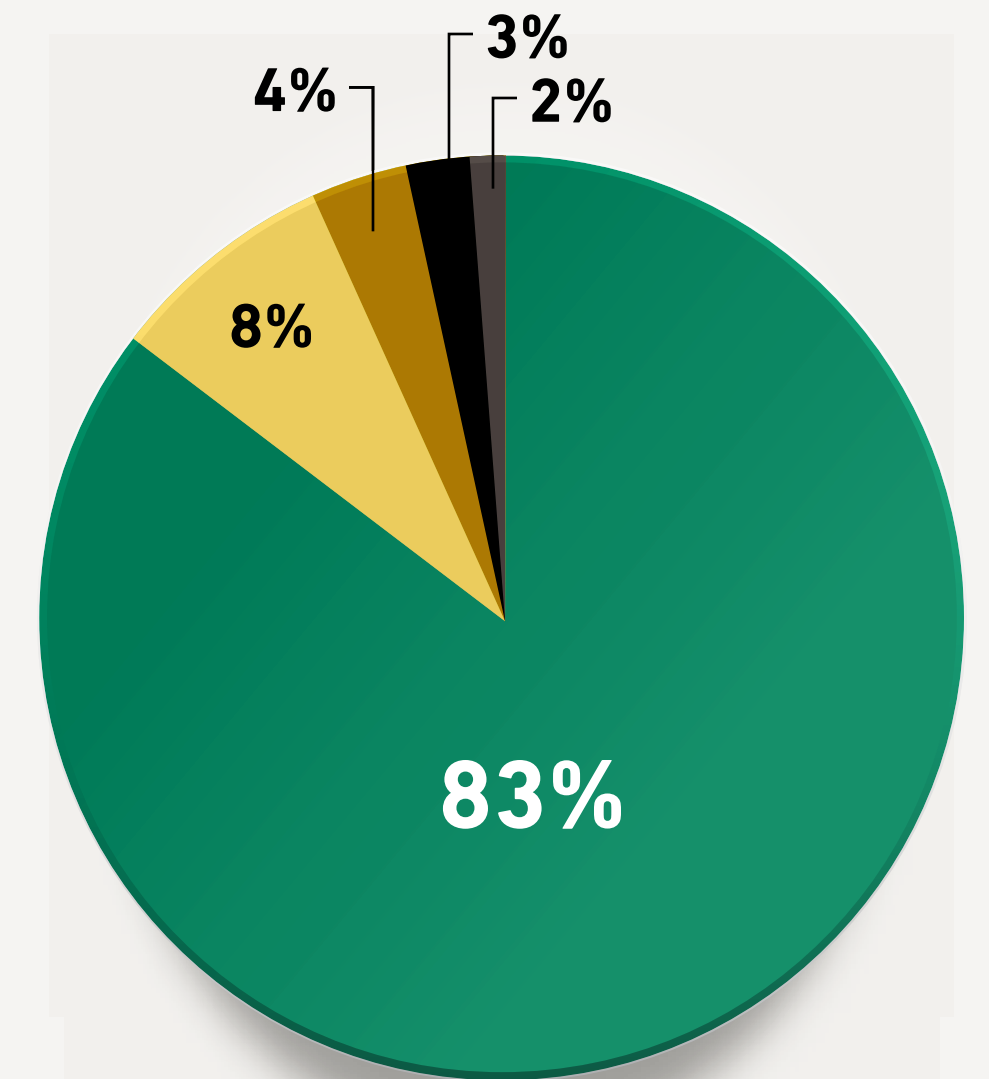
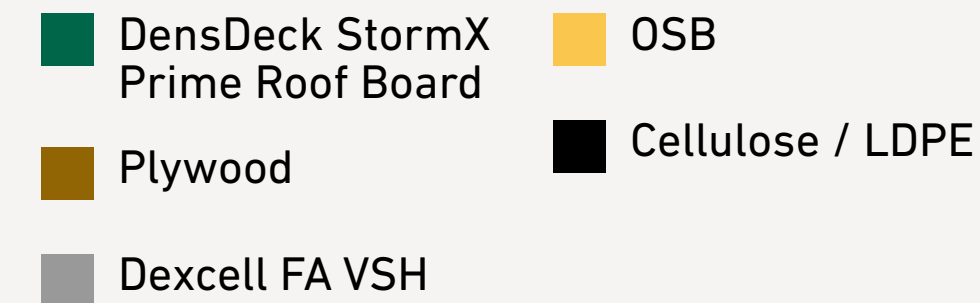
FM Single-Ply VSH Approved
Systems with a Cover Board
(JUNE 2020)



TOTAL = 548

**AFTER DENSDECK STORMX PRIME
ROOF BOARD WAS FM-CLASSIFIED**

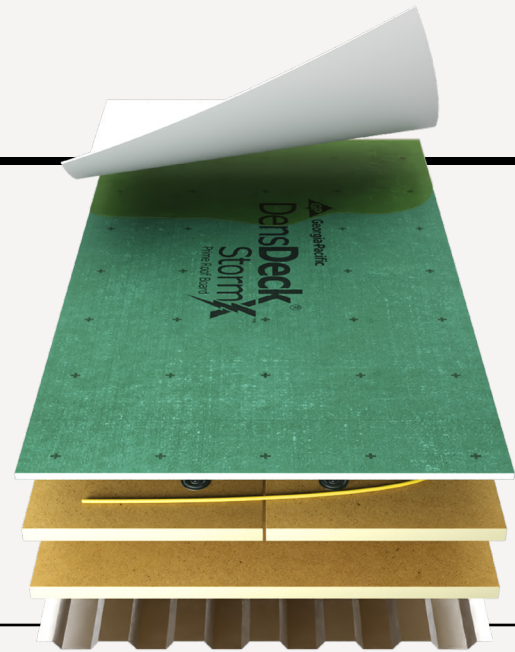
FM Single-Ply VSH Approved
Systems with a Cover Board
(OCTOBER 2022)



TOTAL = 5,661

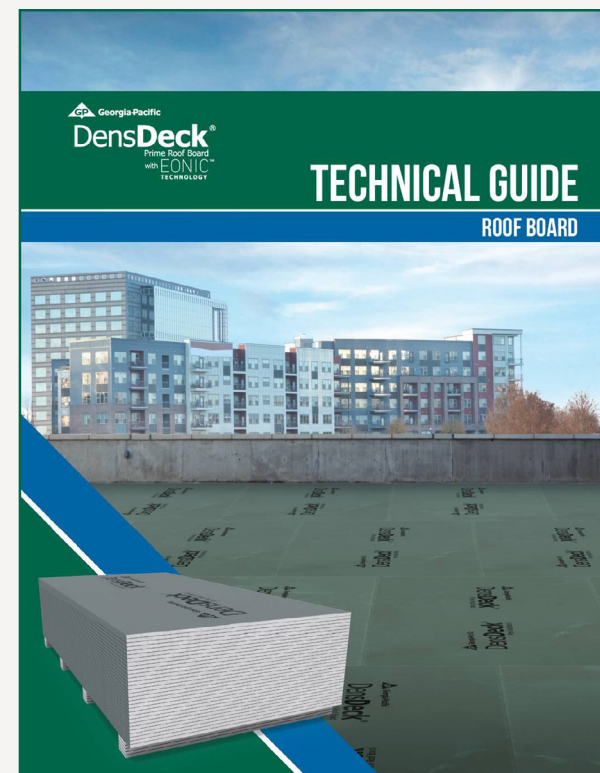
STAYING TRUE TO YOUR SPECIFICATION

Designers and consultants with a design intent for severe weather areas can improve the building's resiliency—and help protect everyone's investment—by specifying DensDeck® StormX™ Prime Roof Board for low-slope commercial roofs.



Get comprehensive product information for DensDeck® Prime Roof Board and DensDeck StormX Prime Roof Board at Georgia-Pacific's resource center.

[View all resources](#)



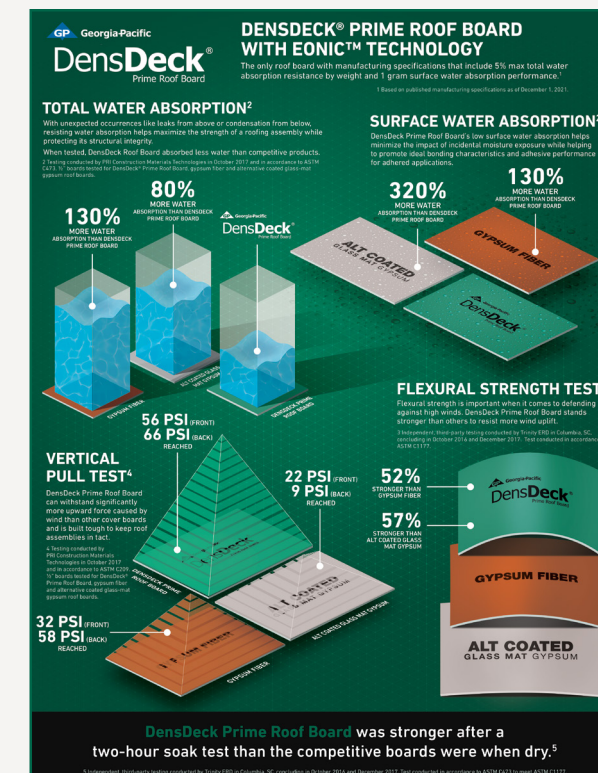
DensDeck® Prime Roof Board Technical Guide



DensDeck® Prime Roof Board and DensDeck® StormX Prime Roof Board 3-Part Spec



DensDeck® StormX™ Prime Roof Board Submittal



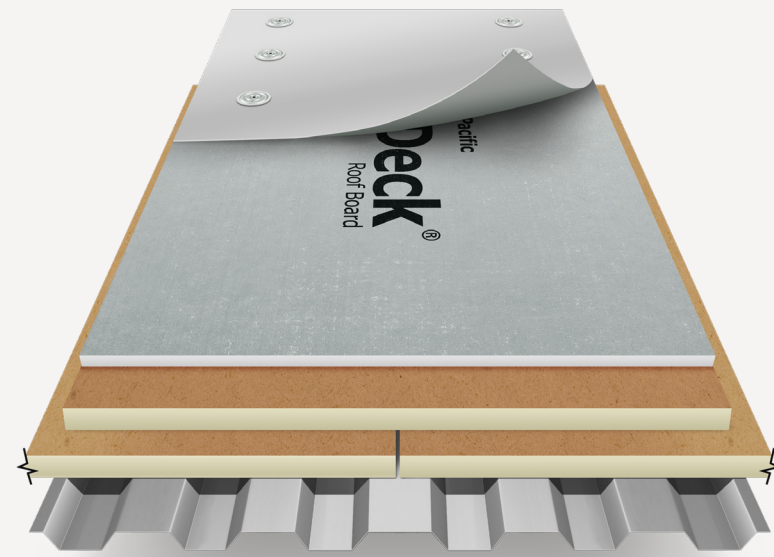
DensDeck® Prime Roof Board Enhancement Flyer



THE FAMILY OF DENSDECK® ROOF BOARDS DOES MORE THAN HELP RESIST SEVERE WEATHER DAMAGE—THERE'S A BOARD FOR EVERY DESIGN INTENT.

Specifying the right substrate can add structural support for future rooftop enhancements like solar panels and HVAC equipment. This added impact protection to both the membrane and insulation of a roofing system helps mitigate the risk of even small punctures that can allow mold to spread and weaken the structure.

GP Georgia-Pacific
DensDeck®
 Roof Board



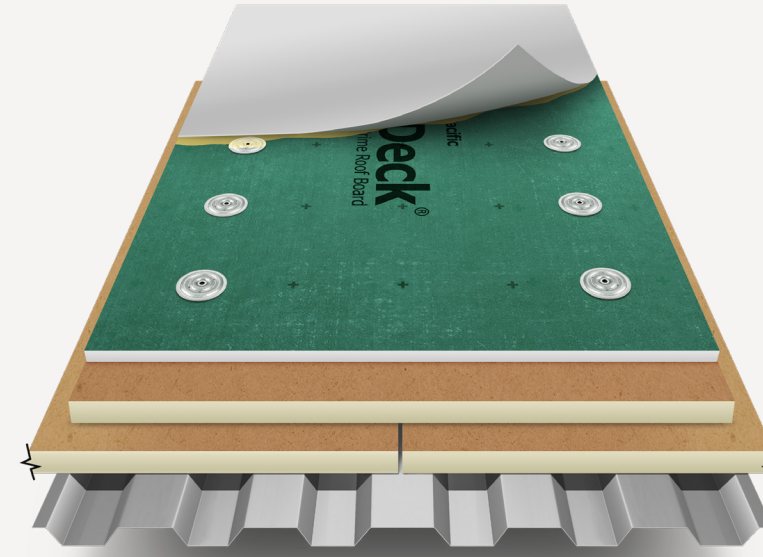
FIRST OF ITS KIND IN ROOF PROTECTION

Georgia-Pacific redefined roof boards in 1987 with DensDeck Roof Board. This innovative cover board provides stronger puncture protection and is noncombustible as a result of its gypsum core. Since 1987, Georgia-Pacific has continued innovating industry-leading high-performance roof boards.



Installation Method:
 For mechanically fastened assemblies

GP Georgia-Pacific
DensDeck®
 Prime Roof Board



ENHANCED MOISTURE RESISTANCE

Building on the legacy of DensDeck Roof Board, DensDeck Prime Roof Board offers even more strength with enhanced moisture resistance for adhered roofing assemblies.

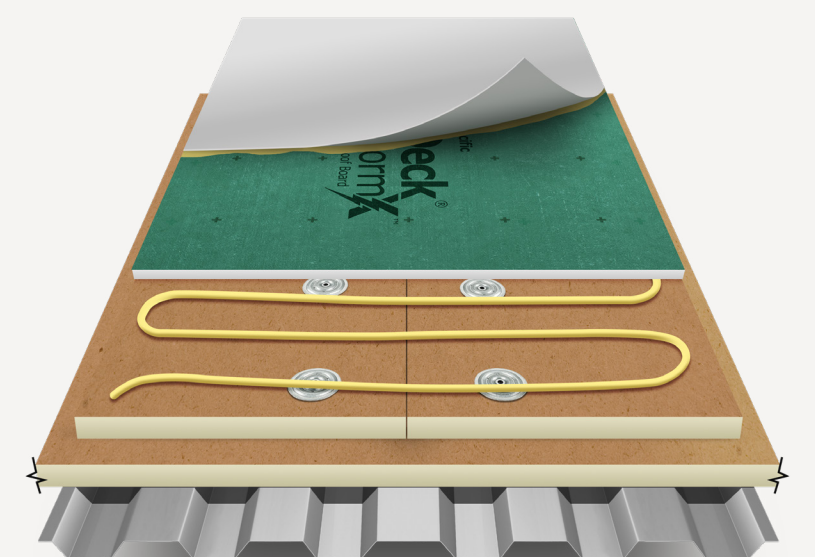


Installation Method:
 For fully adhered, partially adhered and mechanically fastened assemblies



+ Enhanced Moisture Resistance

GP Georgia-Pacific
DensDeck®
 StormX™
 Prime Roof Board



FOR EXTREME WIND AND HAIL CONDITIONS

With enhanced hail, wind and puncture resistance that defies the most extreme weather, DensDeck StormX Prime Roof Board is FM classified for VSH in approved single-ply membrane assemblies.



Installation Method:
 For fully adhered, partially adhered and mechanically fastened assemblies



+ FM classified for VSH in approved single-ply membrane assemblies