RESILIENCE:

An Investment in the Roofing System of the Future

By Ellen Breipohl Thorp, MA, CAE

Just eight days into the new year, the National Oceanic and Atmospheric Administration (NOAA) issued a report that confirmed what millions of Americans had experienced first-hand: 2017 had seen an unprecedented number of natural disasters, which set new records for "billion-dollar" destructive events in the United States. During 2017, 16 "weather and climate disaster events" each accounted for losses exceeding $1 billion, according to NOAA. Together, they caused more than $306 billion in damage and were responsible for the deaths of at least 362 people. While Hurricanes Maria, Harvey, and Irma accounted for more than half of the financial losses, other record-setting disasters included a severe freeze in the Southeast, tornadoes and hailstorms in the Midwest, and droughts and wildfires in the West.

While 2017 may have set a new record for natural disasters in an individual year, it also represents the continuation of a troubling trend of increasingly frequent billion-dollar events that NOAA has tracked since 1980. Even more alarming, this trend is accelerating. From 1980 to 2016, the annual average number of billion-dollar events was 5.5, adjusted for inflation. But for the five years from 2012 to 2016, the annual average has been 10.6 billion-dollar events per year.

Concurrent with this upward trend in disastrous natural events, and most likely driven by it, has been a growing interest in creating a resilient built environment that will protect both people and property from this highly destructive pattern. In 2005, for instance, the Multihazard Mitigation Council (MMC), convened by the National Institute of Building Sciences (NIBS), conducted a widely cited study that documented how every $1 spent on mitigation saves society an average of $4. More than a decade after releasing its original report on mitigation, the Council issued an interim report this January highlighting the benefits of two mitigation strategies. First, the project team looked at the results of 23 years of federally funded mitigation grants provided by the Federal Emergency Management Agency (FEMA), U.S. Economic Development Administration (EDA), and U.S. Department of Housing and Urban Development (HUD), and found mitigation funding can save the nation $6 in future disaster costs for every $1 spent on hazard mitigation. In addition, the project team looked at scenarios that

focus on designing new buildings to exceed provisions of the 2015 model building codes. The report found that investing in mitigation measures that exceed select requirements of the International Code Council (ICC) model building codes can save $4 for every $1 spent.

Other coalitions have been formed to put forward state-of-the-art thinking on protecting the built environment from natural disasters. In 2014, the American Institute of Architects (AIA) and NIBS joined with 19 industry organizations to write and release the landmark Building Industry Statement on Resilience. The effort was the result of a series of summits with the CEOs of many associations whose members are collectively responsible for the planning, design, construction, ownership, and maintenance of buildings and facilities. The 2014 statement noted, "We recognize that natural and man-made hazards pose an increasing threat to the safety of the public and the vitality of our nation. Aging infrastructure and disasters result in unacceptable losses of life and property, straining our nation's ability to respond in a timely and efficient manner." The group underscored that a resilient built environment is needed to improve the economic competitiveness of the United States: "Disasters are expensive to respond to, but much of the destruction can be prevented with cost-effective mitigation features and advanced planning. Our practices must continue to change, and we commit ourselves to the creation of new practices in order to break the cycle of destruction and rebuilding."

Two years later, in May 2016, the Obama White House convened a Conference on Resilient Building Codes "to highlight the critical role of building codes in furthering community resilience and the importance of incorporating resilience and the future impacts of climate change in the codes and standards development process."

Following the conference, the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), the AIA, NIBS, and 37 other leaders of America's design and construction industry released a report on progress made on the resilience front since the Resilience Building Coalition had released its Building Industry Statement on Resilience two years earlier. At the same time, the Resilience Building Coalition also released a set of guiding principles to help the building industry adopt resilient design and policies. These included developing and advocating for codes and policies that advance resilience; developing "whole-systems resilient design" approaches for the built environment; and providing guidance—beyond the baseline life-safety codes—that recognizes the importance of fortifying property for individual and community resilience.

Now, at the beginning of 2018, it is hard to consult a website with even a peripheral interest in building and construction that does not reference resilience. But despite all of this activity related to resilience, there still is some confusion over what is meant by the term. So what exactly do we mean by resilience, and how does it differ from other attributes of a strong structure? According to the Department of Homeland Security, which houses the Federal Emergency Management Agency (FEMA), the term "resilience" refers to "the ability to adapt to changing conditions and

withstand and rapidly recover from disruption due to emergencies. Whether it is resilience towards acts of terrorism, cyber attacks, pandemics, or catastrophic natural disasters, our national preparedness is the shared responsibility of all levels of government, the private and nonprofit sectors, and individual citizens." In other words, "resilience" refers not only to the ability to adapt to changing conditions but also to withstand and rapidly recover from disruption due to emergencies.

It is important to note that while we generally think of catastrophes and other causes of disruption as primarily climate-related, there are other potential causes. In addition to hurricanes, earthquakes, tornados, and intense hailstorms, we also have to be prepared to withstand attacks on our cyber security, physical terrorism, and events such as the Deepwater Horizon oil spill. Hospitals, schools that serve as community shelters, police stations, firehouses, and transit hubs such as subway stations are essential to restoring the wellbeing of a community after these massively disrupting events.

The roof is often critical to protecting a structure during many of these disasters, whether man-made or natural. The Insurance Institute for Building and Home Safety (IBHS), an independent scientific research organization supported solely by property insurers and reinsurers, points out that, "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. It is also the most vulnerable part of your building." While it may be possible to have shelter with a roof and no walls, you certainly can't have shelter without a roof. The roof may also need to be a potential evacuation platform, as well as a platform for mechanical and building operation. While the idea of mechanical equipment on the roof may make many architects and roof/building envelope designers cringe, there's no denying that there is a desire to elevate mechanical equipment to the roof, especially in flood-prone areas.

Given the importance of the roofing system to the overall viability of a building, increasing attention is being paid to what constitutes a resilient roofing system, what are the essential elements needed to create a resilient roof, and what are the essential installation methods that need to be incorporated into the construction process. To identify what is needed to create a resilient roof, and educate the construction community so that resilience can be incorporated into both the new and retrofitted buildings, the EPDM Roofing Association (ERA) has created a Roofing Resilience Task Force. Among the essential elements of a membrane they have identified to be used in a resilient roof are the following:

- Outstanding weathering characteristics in all climates
- Ease of maintenance and repair
- Excellent impact resistance
- Ability to withstand moderate movement cycles without fatigue
- Good fire resistance (low combustibility) and basic chemical resistance

In addition to choosing sound materials, it is also essential to design resilience into a roofing system. To ensure a robust design, the ERA task force has identified the following design elements:

- Redundancy in the form of a backup system/waterproofing layer
- Ability to resist extreme weather events, climate change, or building use
- Excellent wind uplift resistance, but most importantly, being able to withstand multiple load cycles to the limits of its attachment
- Easily repaired by individuals lacking roofing specific skills, with common tools and easily accessible materials, often without access to power tools

ERA, as part of its commitment to provide up-to-date education about roofing issues, has also created a microsite (epdmtheresilientroof.org), designed to serve as a one-stop resource for all roofing professionals. The microsite provides a clearinghouse of sources about resilience, as well as an up-to-date roster of recent articles, blog posts, statements of professional organizations, and other pertinent information about resilience.

There may be controversy surrounding the causes of climate change, but few are disputing the fact that the impact of climate change will be a constant in the coming decades. Our built environment will, no doubt, be exposed to increasing natural and man-made threats. As we move forward, the choice of a roofing membrane will continue to be dictated by the location of a building, its function, and budget parameters. But a resilient roofing system will no longer be just a desirable option in our construction design, but an essential investment that will add value to any building project and protect its occupants and owners from devastating loss.

To find out more about resilience and the value of EPDM in the built environment, go to epdmtheresilientroof.org.

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