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 that 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 disrup-
tion due to emergencies. Whether it is resil-
ience towards acts of terrorism, cyber
attacks, pandemics, or catastrophic natural
disasters, our national preparedness is the
shared responsibility of all levels of govern-
ment, 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 disrup-
tion 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,
tornadoes, 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 com-
"munity 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 disas-
ters, 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 build-
ing’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 plat-
tform, 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 deny-
ing that there is a desire to elevate mech-
anical 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 incor-
porated into the construction process. To
• 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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