Viridiant Lecture Series

planning for resilient and sustainable buildings

A resilient building is also a sustainable building. Buildings that do not need replacement or significant repairs after a disaster are more sustainable by nature. More critically, resilient buildings provide a safe shelter to their occupants during adverse weather events and following days. In this bulletin, we provide resources to help building owners perform a hazard assessment and begin to take action.

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Brock Environmental Center

The Chesapeake Bay Foundation believes buildings should educate, inspire, reduce pollution, and encourage coexistence with nature. The Chesapeake Bay Foundation's (CBF) Brock Environmental Center in Virginia Beach has achieved one of the toughest building standards in the world—Living Building Challenge certification. To meet it, the Brock Center had to prove to be energy and water independent for a full year in operation while meeting strict criteria for location, health and happiness, energy, water, materials, equity, and beauty. With its super energy- and water-efficient features, zero polluted runoff, and near-zero environmental impact, the Brock Environmental Center has also earned the U.S. Green Building Council's LEED Platinum designation.

energy

- Clean, fresh air and natural daylight enter every part of the facility.
- As a result of conservation efforts and innovative technologies, the building uses 80 percent less energy than a typical building that size.
- With its solar panels and residential wind turbines, the building producing nearly twice as much energy as the building has used in the past year.

water

- The center is precedent setting as the first commercial building in the United States to receive a permit to capture and treat rainwater to federal water quality standards for all water uses, including drinking water.
- Composting toilets turn solid waste turns into garden compost used on the property, while liquid waste is made into commercial fertilizer.
- Shower and sink wastewater goes to gardens for natural filtering before returning to the aquifer. The Brock Center's rain gardens and permeable pavers also prevent polluted runoff from entering the neighboring Lynnhaven River.
- The building uses 90 percent less water than a typical office building of its size.

climate-change ready

- Anticipating more flooding from higher water levels in the coming decades, the center is raised 14 feet above sea level.
- There are no paved parking lots to interfere with natural drainage. Any code-required handicap and emergency access areas use permeable pavers that let water soak in rather than run off. Staff and visitors park on nearby streets and walk to the center on a natural path through the woods. And importantly, the surrounding sand, shrubs, and trees remain largely untouched.
- All of this natural, "soft" landscaping serves as a giant sponge, absorbing rainfall and storm surges and allowing flood waters to spread and recede naturally without harm to the center or nearby neighborhoods.

CHESAPEAKE BAY FOUNDATION
Saving a National Treasure

resiliency and sustainable building

As weather becomes more extreme, with hotter temperatures, heavier rainfalls, and higher winds, making buildings more resilient to weather related events is a practical and smart choice. It is possible to make both new and existing construction better equipped to survive harsh weather and protect occupants, both during and after a storm. This bulletin will primarily focus on existing buildings, but is equally applicable to new buildings.

The US Climate Resilience Toolkit (toolkit.climate.gov) provides an intuitive five step process to follow start to finish.

1

The first step is to determine potential threats specific to the building's geographic location. This includes common, known risks like hurricanes, emerging risks like flooding, as well as risks that scientists have determined as likely to arise in the future such as more frequent, severe storms and ocean level rise. Which risks are ultimately addressed is up to the building owner, but during the planning phase, it's valuable to understand the full range of possible adverse events that could impact the structure. For example, in Virginia, flooding, extreme temperatures, a range of storm types, and wildfires are issues that often affect homes and other buildings. These events are often coupled with risks that occur at the same time, such as power outages, or water damage to equipment. A building's susceptibility to risk and severity of risk will vary significantly based on the building's location and unique features.

2

The second step is to assess the building's specific vulnerability and risks to the identified threats. This assessment should also include a consideration of risk potential in a given timeframe. Some people will want to make their building more resilient in the near term while others may consider all vulnerabilities the building is likely to face in the next 100 years. Additionally, the assessment needs to be highly location specific. For instance, a city may be prone to flooding, but if the building itself is on a hill with well-drained soils, flooding may not be a concern for that structure.

Brock Environmental Center, Virginia Beach, VA
Photo: Prakash Patel/SmithGroup JJR

3

After determining risks to the building, the third step is to investigate options to mitigate the potential for adverse impacts from those risks. There are a number of excellent resources available that address various structure types. It's helpful to assess mitigation strategies through two lenses: what can be done to maintain the physical integrity of the structure and what can be done to ensure the building provides safe shelter in the days after an event occurs.

There are several aspects that go into a safe shelter. One is termed "thermal resilience" and is the ability of a building to "coast" in a safe temperature range for humans in the event of a power outage. Well insulated and air sealed structures can coast for long periods of time, and, when passive cooling and heating is integrated, can remain very comfortable. If a building overheats or becomes too cold, it becomes dangerous or uninhabitable for people. The acceptable temperature range is roughly 54°-86°.[1] The two other key aspects to consider are access to food and access to potable water. Will this be provided through ample stocks on site or through regenerative sources such as collecting and filtering rainwater and growing food at the site? The Red Cross recommends storing a two week supply of food and water.[2]

For additional assistance with determining options, here are some available resources.

- Strategies for Multifamily Building Resilience, by Enterprise Communities. This guide is for both new and existing multifamily buildings and addresses protecting the building, improving its ability to adapt to a changing climate, providing backup power for critical needs, and increasing community resilience.[3]
- Disastersafety.org, by the Insurance Institute for Business & Home Safety. This website allows owners of new and existing homes, as well as commercial buildings, to assess threats in their area and find highly detailed technical guides for preparing their buildings for those threats.
- LEED pilot credits[4]: Assessment and Planning for Resilience, Design for Enhanced Resilience, and Passive Survivability and Functionality During Emergencies. These credits are meant for a wide variety of new construction buildings and work through doing a hazard assessment, putting measures into place, and calculating a building's ability to maintain thermal resilience.

4

The fourth step is to create a prioritized action plan. When prioritizing actions, there are several useful factors to keep in mind. First, consider if the risk would impact life safety. Other factors include whether it's a near-term or future risk, the chances of the risk occurring and potential frequency, and the possibility of a mitigation strategy to be high or low cost and provide a high or low benefit. These factors should form a metric that informs the decision making process. Consider how desired measures can be integrated with planned maintenance or replacement of building components. Likely, some measures will overlap with energy and water efficiency measures that are being considered to reduce operating expenses and can be completed as part of "greening" projects.

5

Finally, start to take action. An excellent example of a building undertaking this process, start to finish, is the Brock Environmental Center in Virginia Beach, Virginia. It serves as an office and educational center for the Chesapeake Bay Foundation and is an outstanding example of what can be accomplished through undertaking this five step process. The building has already weathered several significant storms and occupants greatly enjoy the office space year round.

[1] USGBC, http://www.usgbc.org/credits/passivesurvivability
[2] Red Cross, https://www.redcross.org/images/MEDIA_CustomProductCatalog/m4440181_Food_and_Water-English.revised_7-09.pdf
[3] Enterprise Community, http://www.enterprisecommunity.com/resources/ResourceDetails?ID=0100907
[4] USGBC, http://www.usgbc.org/credits/new-construction/v4/pilot-credits