

Resilience in Health Care Facilities

MAY 24, 2019 BY LOUISA HART LEAVE A COMMENT

The hurricanes that pounded portions of the East Coast of the United States in recent years left record-setting destruction in their wake. But they also taught valuable, if painful, lessons about resilience — what works, what doesn't, and what's needed to ensure that the built environment can withstand the predicted increase in these cataclysmic weather events.

These storms, as well as wildfires in the West and tornadoes, hailstorms and extreme flooding throughout the South and Midwest, also drove home the message that hospitals and other health care facilities face unique challenges during times of crisis. They must continue operating to ensure the wellbeing of their patients, meet the needs of staff members who are caring for those patients, and admit additional patients, many of whom may have been injured during the storm. Hospitals frequently house ongoing research and millions of dollars of scientific work could be destroyed if power is lost, or a lab is flooded. Health care facilities are often called on to serve as emergency command centers for entire communities, even during extended utility outages and transportation infrastructure disturbances, and provide such basic necessities as food and water. In fact, in a 2014 report, FEMA cited hospitals, along with public shelters, vital data storage centers, power generation and water and other utilities, and installations which produce, use, or store hazardous materials, as critical facilities “for which the effects of even a slight chance of disruption would be too great.” In other words, hospitals must be able to provide “a standalone level of resilience” independent of the surrounding community and its infrastructure.

The same FEMA report points out that demographics are working to make hospitals even more essential during a crisis, pointing out that the aging population of the United States “will place additional stresses on health care infrastructure.” Finally, while hospitals understand how to organize for the unexpected, other “sub-acute” residential health care settings such as nursing homes, dialysis centers, rehabilitation centers and retail pharmacies tend to be less focused on the stresses that an emergency could put on their systems. Nonetheless, these non-hospital settings need to plan for worst-case scenarios and fully assess their physical vulnerabilities.

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Given the increasing frequency of cataclysmic natural events, there has been a growing awareness that rebuilding health care facilities in the wake of a storm is not a viable approach: to fend off the impact of future storms, it will be necessary to incorporate increased structural resilience to protect both patients and staff during extreme events. In many instances, hospitals have responded, ensuring that their built environment incorporates features that were unheard of even a decade ago.

The Importance of the Roof

In any building, the continued functioning of the roof is essential to protect the interior from water or wind damage, and to maintain a comfortable level of heating or cooling for the interior space. In a health care setting, especially when flooding is an issue, the roof must perform additional essential tasks such as serving as a potential location for evacuation of patients or delivery of essential supplies and personnel. For instance, in the wake of Hurricane Katrina at Tulane Medical Center, the hospital's engineering staff was called on to fashion a makeshift helipad on a parking garage roof to evacuate 200 patients and 1,500 personnel beginning two days after the storm, as generators ran out of fuel or failed and it became apparent that no fuel would arrive. Patients were transported in passenger pickup trucks, as ambulances were too tall to access the parking deck.

Additionally, roofs may be required to support heating and cooling equipment. At Spaulding Rehabilitation Hospital in Boston, opened in 2013, all critical mechanical and electrical infrastructure was placed on the roof and above flood elevations to minimize possibility of interruption. In fact, hospitals in flood-prone regions are being planned and designed "upside-down" with critical infrastructure on rooftops and electromechanical distribution systems fed from the roof downward.

To help the health care sector better prepare for increasingly extreme weather, the Department of Health and Human Services (HHS) has produced the U.S. Climate Resilience Toolkit, devoting one specific section to Building Health Care Sector Resilience. The guide was developed through a public-private partnership with the health care industry and provides an introductory document as well as a suite of online tools and resources that showcase "emerging best practices for developing sustainable and climate-resilient health care facilities." The guide also provides case studies of organizations that are finding innovative ways to deal with the threats posed by extreme weather events.

The toolkit also provides a checklist to help gauge the resilience of a building, focusing in part on conducting a critical building inventory. Questions specific to the roof, or partly pertaining to it, include:

- Have you compiled building envelope and performance vulnerabilities for each critical building?
- Have you reviewed building code design baselines against extreme weather intensities (wind speeds, rainfall volumes, etc.) for each critical building?

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- Have you incorporated expected climate change data over time into building vulnerability assessments?
- What are the design wind loads for roofs?
- What are the design snow loads for roofs? Have rooftop structures and equipment (and their attachments) been reviewed for anticipated wind speeds?
- Have rooftop structures and equipment (and their attachments) been reviewed for extreme precipitation and/or hail vulnerabilities?

A Case in Point

As with most issues related to roofing, the people who have been on the front lines, helping to create a resilient system, are the real experts. Chuck Anderson is Construction Program Director at the University of Texas Medical Branch in Galveston. When Hurricane Ike struck in September 2008, the hospital, encompassing 100 buildings, suffered tens of millions of dollars in damage. Anderson has been one of the people charged with ensuring that the hospital campus, located on a vulnerable low-lying barrier island, is protected from similar future losses. The hospital campus is also required to be self-sustaining for two weeks during and after a storm. As far as priorities for building a resilient roof, Anderson says, “Number one, it is the product. Number two, the installation.” Anderson advocates for a fully adhered system. “You can have the best product in the world, and if it’s not applied correctly, that’s going to blow off.”

Anderson also points out that it’s essential to use a membrane that will withstand “any little blowing object that might put a hole in your roof.” But ultimately, along with state-of-the-art materials and installation methods, Anderson says that additional care is needed; when a storm is predicted, he and his staff walk the roofs to clear them of any debris that could create damage if it becomes windborne. High-tech roofing and low-tech, step-by-step attention to detail — a winning combination to help protect the built environment against increasingly destructive weather events.

To access the U.S Climate Resilience Toolkit and its guide, “Enhancing Health Care Resilience for a Changing Climate”, go to <https://toolkit.climate.gov/image/662>.

For information on incorporating resilience into a roofing system, go to <http://epdmtheresilientroof.org>.

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