Functional Resilience: A New Way to View Sustainability

— By Greg Winkler, AIA, LEED AP, Mid-Atlantic Precast Association

Each year in the United States, billions of dollars in direct property losses are caused by natural disasters. By the middle of 2011, 98 events (including storms, tornadoes, flooding, fires, and earthquakes) had resulted in $27 billion in economic losses—more than double the 10-year average of $11.8 billion, according to Munich Re, a multi-national that insures property insurance companies. Bob Hartwig, head of the Insurance Information Institute, says: "We are rewriting the financial and economic history of disasters on a global scale."

The durability of buildings—their ability to resist storm-related damage—has not often been at the fore of sustainability discussions. The focus of "green buildings" has mostly been on the materials, construction and energy performance of a structure, as well as occupant comfort. Today, the green building movement is extending this to include the overall life of a structure. Doug Gatlin of the U.S. Green Building Council notes that up to 85% of a building's life cycle cost results from operation and maintenance. It has long been accepted that buildings that perform better, require less maintenance, and incorporate more durable and easily-repairable components have lower life-cycle carbon footprints than those with fewer of these attributes. While not a central feature of the U.S. Green Building Council's LEED new construction certification, durability and maintainability are clearly understood to be aspects of a facility's sustainability.

However, what about buildings that suffer excessive storm and weather-related damage from natural events? The environmental impact of demolishing (often landfilling) damaged building materials, and producing, transporting, and installing new materials, is substantial.

The Congressional Research Service estimated in 2008 that Hurricane Katrina damage will ultimately generate more than 100 million cubic yards of disaster debris, costing $3.7 billion in public funds, with much of the demolished material flowing to area landfills. The Federal Emergency Management Agency (FEMA) alone provided hurricane-related support for 950,000 people, including more than $6 billion in aid and 101,000 travel trailers and mobile homes. Katrina was a substantial disaster, of course, but the epic costs of this hurricane across a wide region, and the risings costs of other natural disasters, call into question whether our national building stock is as durable as it should be.

Data developed by the Portland Cement Association (PCA) shows that buildings constructed within the last two decades have suffered more damage and were demolished at a far higher percentage than older structures. PCA assessed other possible causes for this phenomenon, including population migration to more disaster-prone areas, increased volume of residential and commercial construction in recent years, and increased frequency of serious natural disasters. While some of these factors were present, the trend line for property losses is dramatically more severe than can be explained by any factors other than the reduced durability of construction.

The rate of direct loss has dramatically increased over the last twenty years as building codes allowed greater building areas and lighter (Type V) construction in conjunction with the installation of fire protection systems. This "dumbing down" of facility durability is a fundamental fly in the sustainability ointment. The larger meaning of sustainability would seem to demand a building that is more resistant to the ravages of nature. This is nowhere more evident than in shore construction, where insurance companies have begun rebelling against repeat claims of damage from high winds and storm tides. FEMA estimates that such repetitive-loss properties account for 16% of all claims, totaling over $11 billion in losses since 1978, and place the viability of their flood insurance program at stake. These claims result from the simple act of replacing damaged construction with new code-compliant buildings that are no more durable than before. This is a tremendous waste of economic and material resources, and easily corrected by upgrading building and zoning standards to more durable construction. Steve Szoke, PCA's director of codes and standards states: "A sustainable building with a higher degree of durability can decrease the amount of materials going to landfills and use of community resources

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when disasters occur."

States and municipalities are seeking to adopt ordinances and new codes that require more sustainable construction, but they risk overlooking the benefits of promoting more disaster-resistant construction. There needs to be a new awareness of the importance of a structure's ability to withstand routine and predictable natural disasters such as wind, fire, and flood.

Functional Resilience is a term that expresses a structure's durability, competence to maintain its integrity, and ability to have its function restored following environmental change or disaster. First mentioned by the American Concrete Institute (ACI) as part of their *Joint Concrete Sustainability Initiative*, the term was picked up by the Portland Cement Association and incorporated as a concept into their 2010 High Performance Building Standard.

Ensuring that our building stock does not have to be replaced (and thus consume additional resources) may well become an extension of the current definition of sustainability developed specifically for construction. In addition to the benefits of enhanced functional resilience during normal operations, when disasters occur building components are often contaminated or irreparably damaged. The sustainability of high-efficiency building components is sabotaged when they are easily damaged as a result of natural occurrences (weather damage) or human actions (vandalism or sprinkler activation). Building equipment, siding, or finishes that end up in a landfill after such an event can hardly be considered green in the long term.

Functional resilience is a new way to view sustainability. It addresses a one-time attribute of building construction lost in the drive for lower first costs and lighter framing. It argues for a more durable, maintainable, and repairable American architecture. Functional resilience may well be the new heart of sustainability. ■

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