

Structural Engineering Institute (SEI) Publishes White Paper on Resiliency

— Emily Lorenz, PE, LEED BD+C

Earlier this year, the Sustainability Committee of the Structural Engineering Institute (SEI) released a white paper on disaster resiliency. The intent of the paper was to raise awareness of the relationship between sustainability, and disaster resiliency, as well highlight the role that structural engineers can play in improving disaster resiliency, and thus the sustainability of structures. The purpose of this article is to introduce and summarize the main components of the white paper to the readers of *Ascent* since high-performance structures, need to be resilient structures.

The white paper provides explanations of the concepts of sustainability and disaster resiliency, as well as the relationship between the two concepts. Relative to the three high-level concepts of sustainability—economy, society, and ecology—the white paper emphasizes the importance of a resilient structure as one that “provides socially valuable services such as shelter and safety, even in the face of disaster, and it should do so while minimizing economic and environmental costs.”

Statistics on the number of natural disasters or climate disasters and costs are provided in the Natural Disasters and their Consequences section of the white paper. In addition, the future benefit of providing grant programs



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Topography, vegetation, and drought contribute to the potential for devastating wildfires. In this photo, only the concrete structure remains. Photo: Concrete Masonry Association of California and Nevada.

to enhance disaster resiliency during design is documented.

General Considerations and Technical Guidance

The white paper acknowledges that there are a number of resources for resilient design, including both prescriptive and performance-based approaches. This section notes that prescriptive approaches are easier to implement, but a positive outcome due to implementing those approaches is less certain. Alternatively, performance-based approaches are more-difficult to implement but are more likely to achieve the desired results.

There is also a summary and evaluation provided for two major categories of disaster mitigation programs: Comprehensive, Multi-Hazard Programs and Other Resources. These programs can be voluntary or mandatory.

Programs and Resources

There are several industry programs that provide guides to resilient construction, some of which are detailed in the white paper. For example, the FORTIFIED for Safer Living and Safer Business program, which was created by the Insurance Institute for Business and Home Safety (IBHS), is a voluntary program that focuses on reducing:

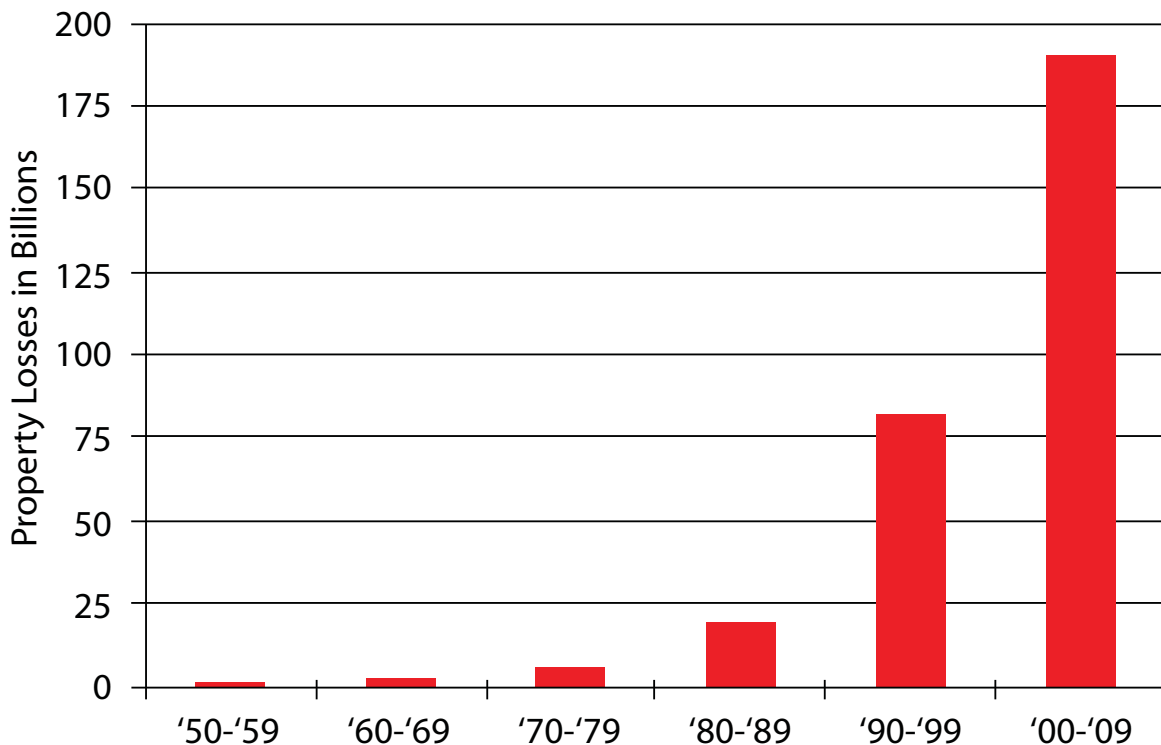
- property losses due to natural disasters, and
- business continuity issues (such as interior fire, burglary, etc.).

Another voluntary program, the High Performance Building Requirements for Sustainability (HPBRS), is attempting to modify the model building codes. Developed originally by the Portland Cement Association, the HPBRS contains design recommendations for interior, exterior, and structural components;

Property Losses¹ due to Natural Disasters²

¹Property losses in billions reported in 2010 adjusted dollars

²Natural disasters excluding floods



Since the 1970s, property losses by decade have increased more than 3500%. Drawing: Portland Cement Association.

fire-protection components; and service life.

The Other Resources section lists programs or references that focus largely on one component of resilient design and disaster mitigation, such as security, earthquakes, or flooding. Here are some examples:

High Performance and Integrated Design Resilience is a multi-hazard program that focuses on security. Developed in 2009 by the U.S. Department of Homeland Security (DHS), the program's goal is primarily to protect structures from explosive blasts and provide security. The DHS has developed software and numerous publications to assist with implementation of this program.

ATC-58 and FEMA P-58 are two complementary tools for performance-based seismic engineering. The ATC-58 provides a computer software program to assist with calculations. A new seismic performance assessment methodology is proposed in FEMA P-58.

CoRE Rating is a rating system developed by the U.S. Resiliency

Council (USRC) to evaluate the resilience of buildings to seismic events. Structures are rated based on the ATC-58 methodology. Resilience-based Earthquake Design Initiative (REDi) rating system also evaluates the resilience of buildings to seismic events, but ratings are based on FEMA P-58 and REDi is broader in scope.

Incorporating Disaster Resilience into Life-Cycle Assessment


After a brief introduction to life-cycle assessment (LCA), this chapter discusses how to incorporate disaster resilience into LCA and current research efforts on this topic. The most-common approach to include disaster resilience in an LCA is "to introduce impact estimation into existing methods for seismic loss assessments." The authors' acknowledge that there is significant uncertainty in estimating disasters, thus including these events in an LCA also has significant uncertainty. More research is ongoing in FEMA, private practice, and by academic researchers.

Current research is included in the white paper.

Funding and Policy Initiatives for Resilience

This white paper also provides several resources for funding to implement resiliency in design and discusses the benefits of providing such incentives.

A Useful Tool for Engineers, Designers

The resources presented in the SEI disaster resilience white paper are useful to engineers, architects, owners, and designers. Originally written with the structural engineer in mind, the thoughtful consideration of all aspects related to resilient design prove helpful to all on the design team. More information, including a copy of the white paper, can be found at: <https://sites.google.com/site/seisustainabilitycommittee/working-groups/disaster-resilience-white-paper>. 

For more information, visit www.pci.org/ascnt.