**BSESC—Disaster Resistance and Resiliency**

## Proficiency Level 1: Remember

### Learning Objective 1.1

* List the four fundamental principles of resistance for all-hazard building design.

### Lecture Notes 1.1

Although often used interchangeably, within the building profession, disaster resistance refers to the ability to resist the onset and impact of a disaster, and disaster resiliency refers to the ability to absorb the impact of a disaster. Some examples of resistance include applying building codes to protect against earthquakes, fire, and high winds and applying best-practice standards. Some examples of resiliency during an emergency and after are the electronic grid operating (or coming back online quickly), accessible potable water, and working community roads and services. Disaster resistance and resiliency are very closely interrelated and involve planning and responding from a specific building level to the community and national level with all applicable professionals and with the specific building occupant/owner.

Four fundamental principles of resistance are essential for all-hazard building design (NIBS 2017):

* **Plan for fire protection**—Use a systems approach that enables the designer to analyze all of the building's components as a total building fire safety system package.
* **Protect occupant safety and health**—Implement measures that take into account issues such as indoor air quality, electrical safety, fall protection, ergonomics, and accident prevention.
* **Mitigate for natural hazards**—Anticipate the damaged buildings and infrastructure risks associated with major natural disasters, such as impacts from hurricanes, floods, earthquakes, tornados, blizzards, and other natural disasters.
* **Provide security for building occupants and assets**—Implement countermeasures to deter, detect, delay, and respond to attacks from human aggressors. It also provides for mitigating measures to limit hazards to prevent catastrophic damage and provide resiliency should an attack occur.

For new buildings, code requirements serve to define the minimum disaster resistance requirements for a local area, but minimum compliance with codes in building design is not always sufficient to guarantee that a facility will perform adequately when impacted by the forces for which it was designed. Therefore, effective building resistance involves the application throughout a building’s lifecycle (from planning to upgrades/remodeling) of regulations, codes, model codes, standards, and best practices and planning and interaction with the larger community, which interconnects with resilience.

### Learning Objective 1.2

* List the three key features of resilience in infrastructures.

### Lecture Notes 1.2

For new buildings, code requirements serve to define the minimum disaster resistance requirements for a local area, but minimum compliance with codes in building design is not always sufficient to guarantee that a facility will perform adequately when impacted by the forces for which it was designed. Therefore, effective building resistance involves the application throughout a building’s lifecycle (from planning to upgrades/remodeling) of regulations, codes, model codes, standards, and best practices and planning and interaction with the larger community, which interconnects with resilience.

“Infrastructure resilience is the ability to reduce the magnitude and/or duration of disruptive events. The effectiveness of a resilient infrastructure or enterprise depends upon its ability to anticipate, absorb, adapt to, and/or rapidly recover from a potentially disruptive event” (NIAC 2009).

Resilience is characterized by three key features (NIAC 2009):

* “Robustness: the ability to maintain critical operations and functions in the face of crisis. This includes the building itself, the design of the infrastructure (office buildings, power generation, distribution structures, bridges, dams, levees), or in system redundancy and substitution (transportation, power grid, communications networks).
* Resourcefulness: the ability to skillfully prepare for, respond to, and manage a crisis or disruption as it unfolds. This includes identifying courses of action and business continuity planning, training, supply chain management, prioritizing actions to control and mitigate damage, and effectively communicating decisions.
* Rapid recovery: the ability to return to and/or reconstitute normal operations as quickly and efficiently as possible after a disruption. Components [of rapid recovery] include carefully drafted contingency plans, competent emergency operations, and the means to get the right people and resources to the right places.”

The National Institute of Building Sciences (NIBS 2017) proposes another key feature of resilience: redundancy, meaning back-up resources to support the originals in case of failure.

Resilience is multidisciplinary and needs the cooperation of different disciplines for successful outcome. An integrated design process is essential for disaster resistance and resiliency in building, in which all building professionals understand the safety and security goals and the interrelationship of these goals with other design objectives (i.e., sustainability, cost effectiveness, accessibility, functionality, and productivity).

## References

National Infrastructure Advisory Council (NIAC). September 8, 2009. *Critical Infrastructure Resilience Final Report and Recommendations*. Prepared by the National Infrastructure Advisory Council through the U.S. Department of Homeland Security. <https://www.dhs.gov/sites/default/files/publications/niac-critical-infrastructure-resilience-final-report-09-08-09-508.pdf>.

National Institute of Building Sciences. 2017. *Whole Building Design Guide*. “Design Objectives—Secure/Safe.” Available in sections online at <https://www.wbdg.org/design-objectives/secure-safe>.