COMMUNICATING A BUILDING’S CONTRIBUTION TO COMMUNITY RESILIENCE

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ABSTRACT

A community’s resilience to significant earthquakes depends on the resilience of the people and their social and economic institutions. A resilient built environment is also needed that reliably supports the daily needs of the community and predictably recover from such low probability-high hazard events. The National Institute of Standards and Technology Community Resilience Planning Guide for Buildings and Infrastructure Systems directs the systematic definition of what performance is needed from the built environment through a process of understanding the social and economic institutions and defining the building clusters and infrastructure systems ability to recover. Fundamental to the process is understanding the vulnerability of the buildings in clear and usable terms. The USRC Rating program is an independent, effective, dependable, efficient, and way to judge and record the vulnerability of individual buildings and their contribution to a community’s ability to recover. Their Platinum, Gold, Silver and Certified ratings clearly provide the needed information to resilience planners and the public at large.

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A community’s resilience to significant earthquakes depends on the resilience of the people and their social and economic institutions. A resilient built environment is also needed that reliably supports the daily needs of the community and predictably recovers from such low probability-high hazard events. The National Institute of Standards and Technology Community Resilience Planning Guide for Buildings and Infrastructure Systems directs the systematic definition of what performance is needed from the built environment through a process of understanding the social and economic institutions, and defining the building clusters and infrastructure systems’ ability to recover. Fundamental to the process is understanding the vulnerability of the buildings in clear and usable terms. The USRC Rating program is an independent, effective, dependable, efficient, and verified way to judge and record the vulnerability of individual buildings and their contribution to a community’s ability to recover. Their Platinum, Gold, Silver and Certified ratings clearly provide the needed information to resilience planners and the public at large.

Introduction

A community’s resilience to significant earthquakes depends on the resilience of the social and economic institutions. Resilient communities enjoy social equity and stability, economic vitality, and environmental sustainability. A resilient built environment is also needed that reliably supports the daily needs of the institutions and can predictably recover from low probability-hazard events such as earthquakes. The investment of community resources across these institutions is best allocated when a clear understanding of community wide capacities and deficiencies including the vulnerability of the buildings and infrastructure systems is understood.

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The National Institute of Standards and Technology (NIST) publication *Community Resilience Planning Guide for Buildings and Infrastructure Systems* [1] was specifically developed to systematically define what performance communities need from their buildings, building clusters and lifeline systems (power, transportation, communication, water and waste water). Through a process of understanding their social and economic institutions and defining the building clusters and infrastructure systems needed to support them, communities can identify the areas of weakness (gaps between needed and available performance) in their built environment and take steps to address the deficiencies through recovery plans, mitigation programs and resilient design criteria. It is fundamentally important that they know if their buildings will be safe, when they will be usable, and how much the needed repairs will cost.

**Defining and Communicating Building Performance**

Advances in structural and earthquake engineering have provided the tools needed to design and declare the performance of buildings for earthquake hazards, though the results have not been widely disseminated. Consensus based national building codes have emerged that provide prescriptive requirements for essential facilities to remain usable after an expected event, schools, high occupancy buildings and hazardous material facilities to be designed to a higher level of reliability, and all other buildings to be safe against collapse. Earthquake professionals generally believe that their new designs will be safe and in most cases repairable after design level events. They also know that most of the existing buildings built before current standards were adopted will also be safe though many will not be repairable in such an event, and some of them will be subject to collapse. Unfortunately, communities in general don’t understand this reality because the communication from the design community has historically been in technical terms that avoids directly declaring the expected performance. Performance based engineering was introduced to address this problem, but the technical terms used did not significantly improve understanding. [2]

Practicing Structural Engineers have approached defining building safety and usability in different ways. Since the early 1980’s, The Applied Technology Council (ATC) has developed a series of guidelines for use in determining the performance of buildings in significant earthquakes. The most recent methodology, FEMA P-58, introduced the next generation procedure to determine and transparently describe expected behavior in terms of occupant safety, cost of repairs, and the time needed to restore operation. [3]. These concepts are in use by design professionals and have been advanced into various formal rating systems that link the technical aspects of a building’s strength and durability with safety and usability.

At least three formal rating systems have been developed based on the ATC methodology. ARUP’s REDI program (REDi Rating System: Resilience-based Earthquake Design Initiative for the Next Generation of Buildings) has been developed for use in a new building design environment [4]. The Structural Engineers of Northern California (SEAONC) developed EPRS (Earthquake Performance Rating System) that was tailored to assessing existing buildings. [5]. Building on the SEAONC EPRS and the FEMA P-58 methodology, the United States Resiliency Council (USRC) created an independent, impartial rating program (like the LEED program) that allows the use of multiple techniques and includes a posting opportunity. The USRC program, with its engineer certification and technical review process, provides a comprehensive, consistent, and verified approach that provides information on building performance in terms of the three-critical metrics
- safety, repair cost, and time needed to return to function. A USRC Rating declares one of five levels (stars) of expected performance for each metric in specific terms, and a single certified, silver, gold, and platinum overlay to communicate that performance to the public. Table 1 shows the definition of the ratings which inform individual owners about the safety of their occupants and vulnerability of their assets. Their Insurance companies can use this information to better quantify risk and exposure. [6]

Table 1: USRC Rating Definitions

USRC Platinum Rating represents the highest level of building performance and is intended to exceed modern code standards in terms of safety, by protecting occupants against major injury and egress restrictions. Platinum rated buildings are expected to suffer negligible damage - less than 5% of replacement cost, and allow full functional recovery within a few days of a major seismic event. The USRC Platinum Rating is sought by owners who demand the highest level of asset protection and virtually uninterrupted functionality of their operations.

USRC Gold Rating represents a very high level of performance that is intended to exceed modern code standards in terms of safety, by protecting occupants against major injury. Gold rated buildings are expected to suffer only minor damage - less than 10% of replacement cost, and allow full functional recovery within several weeks of a major seismic event. The USRC Gold Rating is sought by owners who demand high levels of asset protection and minimal disruption to their operations.

USRC Silver Rating is for buildings that in addition to meeting the Certified standards are expected to suffer significantly reduced damage - less than 20% of replacement cost, and allow full functional recovery within a few months of a major seismic event. The USRC Silver Rating is awarded to buildings where limiting damage is an important consideration, as for properties with commercial loans and in the transactional due diligence market.

USRC Certified Rating is for buildings that have been evaluated by the US Resilience Council and comply with modern codes for performance in earthquakes. Certified buildings are expected to perform in a manner that will preserve life safety of the occupants, limit damage to repairable levels under 40% of replacement cost, and allow full functional recovery within a year of a major seismic event. Nearly 60% of most cities’ existing building inventories will not comply with this standard. The USRC Certified Rating signifies that a building is expected to achieve a level of performance consistent with new building standards.

Building Rating System’s Contribution to Community Resilience

The NIST Community Resilience Planning Guide defines the resilience of a community’s built environment in terms of building clusters and supporting infrastructure systems. Building clusters are defined as a set of buildings not necessarily geographically co-located, that serve a common function such as housing, healthcare, retail, etc. These clusters are organized in four functional groups with similar performance goals. All buildings are expected to be safe (occupants are safe inside during a hazard event and able to exit the building without assistance). Additional, specific performance goals are set for each building cluster in terms of how soon 30%, 60% and 90% of the buildings in the cluster will regain the usability needed for the institution they serve. The vulnerability of the individual buildings in the community are then evaluated, cluster by cluster, and the results compared to the performance goals that have been set. The differences, or gaps, then become the basis for administrative and construction related programs to close the gaps and improve the community’s resilience. The USRC Rating program is an effective, dependable, verified, and efficient way to judge and record the vulnerability of individual buildings and their ability to contribute to the performance that is needed. Such detailed information also allows
communities to better balance their seismic mitigation programs with the investments needed to improve the resilience of their social, economic and environmental institutions.

Conclusions

Community resilience is a multifaceted concept that must address the social, economic, environmental and built infrastructures. The built infrastructure (buildings, buildings clusters, and infrastructure systems) must be able to support a community’s Social and Economic institutions under both normal conditions and in the event of low probability-high consequence events and the infrastructure systems need to support the functions served by the buildings. The NIST Community Planning Guide provides a framework for organizing the needed goals for the built environment including the return to function times necessary to contribute to community resilience. The existing built environment has not been designed to provide this level of performance and communities need to understand their vulnerability in terms of how long it will take and how much it will cost to recover. The USRC Rating program is an independent, effective, dependable, efficient and verified way to judge and record the vulnerability of individual buildings and their ability to contribute to the performance that is needed.

References