

# Community resilience and the U.S. Resiliency Council's Building Rating System

R.L. Mayes

*Simpson Gumpertz & Heger Inc.  
Chair USRC Board*

E. Reis

*USRC Executive Director*



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**ABSTRACT:** The notion that there is a disconnect between the anticipated performance of buildings in a major earthquake, and what the public understands or expects, is not new. The thought was that if the public could be made more aware of their potential seismic risk, they could be expected to make better-informed decisions on owning and leasing properties, and market forces would eventually drive the building design, management, and procurement process into more resilient seismic design.

Measuring and improving the resiliency of the country's communities is a national imperative, and there are a number of major efforts in progress in the US to address this issue. What all of these initiatives have in common is the need to understand the performance of the building stock in terms of safety and recovery.

The United States Resiliency Council (USRC) is modeled after the U.S. Green Buildings Council (USGBC®). Like the USGBC, the USRC will certify practitioners and technically review ratings shared with the public so that USRC ratings are credible and consistent. The USRC offers the structural engineering profession a unique opportunity to better communicate with both clients and the public about the performance of buildings we design and retrofit.

This paper will overview some of the resilience initiatives that are in progress in the United States and will focus on the importance of the USRC building rating system in these bigger picture initiatives. It will also outline the USRC outreach efforts underway to begin the implementation of the rating system.

## The Need for a Building Rating System

With current assessment tools such as FEMA 154, *Rapid Visual Screening of Buildings for Potential Seismic Hazards: A Handbook, Second Edition* (FEMA, 2002); ASCE 31, *Seismic Evaluation of Existing Buildings* (ASCE, 2003); ASCE 41, *Seismic Rehabilitation of Existing Buildings* (ASCE, 2014); and FEMA P-58, *Next-Generation Performance Assessment of Buildings* (assessment procedures newly released), the concept of a new system to rate the performance of buildings would seem unnecessary, or at least redundant.

Although these procedures and tools would be key inputs to a building rating system, they currently alone cannot do what a comprehensive rating system would do:

- Communicate levels of performance to broad-based, non-technical audiences
- Address new and existing buildings in a consistent context
- Correct popular misconceptions about expected building performance
- Provide multiple measures of performance to suit different decision-making needs
- Provide a context for public policy decisions and market forces to encourage and reward better performing designs
- Provide the critical information on the performance of a community's building stock for the broader resilience developments that are in progress

Currently available tools have reached a level of sophistication and maturity that we now feel capable of distilling complex measures of performance into meaningful sound-bite information that is expected

to be useful to owners, developers, tenants, lenders, and insurers in their building procurement transactions.

## The United States Resiliency Council (USRC)

The United States Resiliency Council was conceived based on ideas originating from the Structural Engineers Association of Northern California (SEAONC) as early as 2006, and input obtained from the Federal Emergency Management Agency (FEMA) funded workshop on a rating system in 2011. The stated mission of the USRC is to establish and implement meaningful rating systems that describe the performance of buildings during earthquakes and other natural hazard events, to educate the general public to understand these risks, and thereby improve societal resiliency.

The vision for the USRC is that it will play a similar role that USGBC performs for sustainable design. It will provide a non-profit organization to promote and implement a rating system, and educate the public about seismic and other hazard risks (hurricane/tornado, flood, and blast) associated with buildings. It will also bring together all stakeholder groups concerned about the safety of buildings into leadership and advisory positions.

Recent papers (Mayes and Reis 2015, and Reis and Mayes 2015) covers the goals and objectives, organization, and founding principles of the USRC, the potential users, the information it provides and the measures that will be used to maintain the long term credibility of the system. Papers by Haselton et al 2015 and Hohbach et al 2015 describe in detail the two evaluation methodologies approved to develop a USRC rating. The only additional change to the USRC Rating System to that described in the references above is the color overlay of platinum, gold, silver, and bronze ratings shown in the placards below. A building designed to current codes will as a minimum have a bronze rating and in all likelihood will be silver rated.



## Rating System Dimensions and Definitions

The USRC rating system dimensions and definitions are based on ideas and concepts from the SEAONC Earthquake Performance Rating System (Stillwell et al., 2008; SEAONC 2009, 2011, 2012). These have since been vetted by the USRC Technical Advisory Committee and the USRC Stakeholders Advisory Committee. The current USRC system consists of three rating dimensions (safety, repair cost, and time to regain basic function):

- The SAFETY rating dimension addresses thresholds for the building in terms of the potential for people in the building to get out after an earthquake event and avoid bodily injuries or loss of life.
- The REPAIR COST rating dimension is an estimate of the cost to repair the building after the earthquake event. REPAIR COST is defined as a percentage of the building's overall replacement cost prior to the earthquake.
- The TIME TO REGAIN BASIC FUNCTION rating represents an estimate of the minimum timeframe to carry out sufficient repairs and to remove major safety hazards and obstacles to regain occupancy and use of the building, but not necessarily restore it to its full intended functions and operations as it existed prior to the earthquake.

Within each dimension, definitions are keyed to five levels of performance. Levels of performance are communicated using star symbols, with more stars equating to higher (or better) performance. The

details of the definitions can be found on the USRC web site ([www.usrc.org](http://www.usrc.org)) or in the paper by Mayes and Reis 2015.

## **Users of the Rating System**

The rating system is usable by all occupants, buyers, sellers, and tenants of a building. The audience for the system includes a broad and general population, many of whom know little about seismic risk. The most frequent users may be facility experts (structural engineers, brokers, insurance industry, investors), and the system is usable by all who assess, quantify, reduce, mitigate, insure, or accept risk. However, the system requires integrity and clarity without regard to the users or their desires. A potential list of users includes:

- On-site—tenants, lessees, employees
- Real estate—
  - Developers, brokers, property managers
  - Owners and potential owners (investors, corporations, governments, individuals)
  - Financial sector—lenders, insurers, re-insurers
- Public sector—utilities, planners, local agencies, schools, religious institutions, federal agencies, and anyone interested in the resilience of their community
- Building professionals—engineers, architects, contractors

## **Overview of Current Significant Efforts to Develop Community Resilience in the United States**

Measuring and improving the resiliency of the country's communities is a national imperative, and there are a number of major efforts in progress to address this issue. A partial summary includes:

- Los Angeles City - Resilience by Design
- San Francisco City - Resilience Strategy and Earthquake Implementation Program
- Alliance of National and Community Resilience
- 100 Rockefeller Cities Initiative
- National Institute of Standards and Technology's (NIST) Community Resilience Panel for Buildings and Infrastructure Systems
- National Institute of Building Sciences – Developing Pre-Disaster Resilience Based on Public and Private Incentivization
- National Resilience Initiative by the Foundation of the Architects Institute of America
- U.S. Green Building's Council new initiative for three pilot resilience points

There are also many other efforts at both the State and Local level. What all of these initiatives have in common is the need to understand the performance of the building stock in a community in terms of safety and recovery.

## **Los Angeles City – Resilience by Design**

In December 2014, Los Angeles Mayor Eric Garcetti released Resilience by Design - a plan to address the city's greatest earthquake vulnerabilities, including building retrofitting, voluntary use of an earthquake rating system, and steps to secure our water supply and communications infrastructure.

Mayor Garcetti's Science Advisor for Seismic Safety, Dr. Lucy Jones, a renowned United States Geological Survey seismologist, led the development of this report and assembled technical experts and consulted with businesses, property owners, and other stakeholders to help inform the City's action steps. Mayor Garcetti's plan would require retrofitting of two types of vulnerable buildings. Retrofits would be required within 5 years at "soft-first-story" buildings built prior to 1980, and retrofits would be

required within 25 years at "non-ductile reinforced concrete" buildings built prior to 1980. The plan recommends significant investments in fortifying our city's water supply, including developing an alternative water system for firefighting, protecting our aqueducts that cross the San Andreas Fault, increasing local water sources, and developing a network of resilient pipes.

The plan also calls for upgrades to our city's telecommunications network to enable Internet and mobile connectivity after an earthquake, including creating partnerships with providers for shared broadband services after disasters, protecting power systems at fault crossings, creating a solar-powered citywide Wi-Fi network to avoid power disruptions, and fortifying cell phone towers.

*"We acknowledge that we cannot prevent 100% of the losses in an earthquake. What we are trying to do is prevent the catastrophic collapse of our economy by addressing the biggest vulnerabilities," said Dr. Lucy Jones. "And if all of these recommendations are enacted, I believe that Los Angeles will not just survive the next large earthquake but we will be able to recover quickly and thrive."*

You can read an executive summary and the entire Resilience by Design report at [www.lamayor.org/earthquake](http://www.lamayor.org/earthquake).

The U.S. Resiliency Council is fully supportive of the Mayor's recommended program that includes the voluntary use of the USRC Building Rating System for the Earthquake Performance of Buildings. Los Angeles will be the first city in the world to adopt the Rating System and it will bring market forces to bear on the long term resilience of the City. This is a bold and important development.

### **San Francisco Office of Resilience & Recovery to Protect Lives & Safeguard City Against Next Earthquake or Disaster**

San Francisco Mayor Edwin M. Lee announced in April 2016 the release a citywide resiliency strategy created as part of a grant from 100 Resilient Cities (100RC). One of the recommendations of the City's Resilient San Francisco – Stronger Today, Stronger Tomorrow – is the launch of the new Office of Resilience and Recovery.

*"San Francisco has a history of solving our challenges through bold action," said Mayor Lee. "On the anniversary of the 1906 Great Earthquake and Fire, we remember our City's past and look to the future. This new office will oversee the implementation of the resilience strategy and continue to work alongside City departments and work with our communities to ensure we are taking the steps necessary to make sure San Francisco rapidly recovers from any emergency."*

*"Disasters amplify our existing problems," said San Francisco Chief Resilience Officer and Office of Resilience and Recovery Director Patrick Otellini. "This strategy is focused on minimizing the impacts of disasters by doing what we can now to actively plan for a robust and inclusive recovery. That means taking action now."* In 2014, San Francisco was one of the first cities selected from a pool of approximately 400 applicants to join the 100RC network, along with Oakland, Berkeley, and Los Angeles. In addition to creating the Office of Resilience, the strategy features 54 specific initiatives aimed at creating a more resilient San Francisco.

### **Alliance for National and Community Resilience**

This is a new non-profit organization that has recently been incorporated. The mission of the Alliance is dedicated to providing the tools communities need to evaluate their capability to withstand, respond to, and recover from hazards that threaten the social, economic, and environmental well-being of its citizens and businesses.

The need for a Community Resilience Benchmark System can be summarized as follows:

- To help communities understand their resilience
- To provide the ability to assess and measure communities' resilience
- To incentivize communities to strengthen capacities and address vulnerabilities
- To reward and recognize communities for taking resilient action

### **100 Resilient Cities (100RC)**

Pioneered by the Rockefeller Foundation, 100RC is dedicated to helping cities around the world become more resilient to the physical, social, and economic challenges that are a growing part of the 21st century. 100RC supports the adoption and incorporation of a view of resilience that includes not just the shocks—earthquakes, fires, floods, etc.—but also the stresses that weaken the fabric of a city on a day-to-day or cyclical basis. Examples of these stresses include high unemployment; an overtaxed or inefficient public transportation system; endemic violence; or chronic food and water shortages. By addressing both the shocks and the stresses, a city becomes more able to respond to adverse events, and is overall better able to deliver basic functions in both good times and bad, to all populations.

Cities in the 100RC network include both Christchurch and Wellington and they are provided with the resources necessary to develop a roadmap to resilience along four main pathways:

- Financial and logistical guidance for establishing an innovative new position in city government, a Chief Resilience Officer, who will lead the city's resilience efforts
- Expert support for development of a robust resilience strategy
- Access to solutions, service providers, and partners from the private, public, and non-governmental organization (NGO) sectors who can help them develop and implement their resilience strategies
- Membership of a global network of member cities who can learn from and help each other

### **NIST Community Resilience Panel**

The NIST Panel will develop products, such as guidance, best practices, project plans, case studies, and recommendations to address specific resilience topics or gaps in current codes and standards. The Panel will also develop and maintain a Resilience Knowledge Base (RKB) of informative reference materials and products for communities.

The mission of the Panel is to reduce barriers to achieving community resilience by promoting collaboration among stakeholders to strengthen the resilience of buildings, infrastructure, and social systems upon which communities rely. The Panel will consider the adequacy of standards, guidelines, best practices and other tools and recommend, develop, and work with others to make improvements in community resilience.

### **National Institute of Building Sciences – Developing Pre-Disaster Resilience Based on Public and Private Incentivization**

Recent major disasters, such as Hurricanes Katrina and Sandy—and their considerable financial, social, and environmental impacts—have substantially raised the profile of resilience in communities, in policymaker deliberations, and within the buildings and infrastructure industry. In May 2014, more than 20 organizations representing the planning, design, construction, operations, and management disciplines came together, in conjunction with Building Safety Month, to issue a statement on the importance of resilience and the need for a multi-disciplinary, collaborative, and coordinated approach to assure the safety of U.S. citizens.

Resilience has come to occupy a place in public policy and programs across the United States. Yet, even in the face of growing losses and the deleterious effects of natural disasters, the nation's capacity and appetite is waning for continued funding of federal and state pre- and post-disaster mitigation efforts to create resilience. A new approach is necessary—one focused on capturing all of the potential incentives provided by both the public and private sectors for pre-and post-hazard investment. The most cost-effective manner to achieve resilience is through a holistic and integrated set of public, private, and hybrid programs based on capturing opportunities available through mortgages and loans; insurance; finance; tax incentives and credits; grants; regulations; and enhanced building codes and their application. This focus on private/public-sector opportunities to induce corrective action is called "incentivization."

The Institute's effort to advance investments in mitigation and resilience continues. Through the Multi-hazard Mitigation Council, industry experts have initiated two important efforts to support community resilience. This white paper, *Developing Pre-Disaster Resilience Based on Public and Private Incentivization*, developed in conjunction with NIST's Council on Finance, Insurance and Real Estate,

identifies the potential mechanisms from both the public and private sectors that can drive investment in mitigation—an approach called “incentivization.” This expanded assessment of opportunities to encourage mitigation investments identifies mechanisms outside those currently offered by government programs.

### **National Resilience Initiative (NRI) by Architects Foundation**

The National Resilience Initiative (NRI) is a program of the Architects Foundation with partners including the American Institute of Architects, the Rockefeller Foundation's 100 Resilient Cities, the Clinton Global Initiative, and the Association for Collegiate Schools of Architecture and Public Architecture. The intent is to create a nationwide professional and academic network of design studios to advance resiliency in the built environment. Together, these studios form the National Resilient Design Network (NRDN).

### **U.S. Green Building Council – Three Pilot Resilience Points**

Sustainability promotes designs that reduce our impact on the environment. The USGBC LEED system, Green Globes, and other sustainable rating systems have revolutionized the industry for green construction. However, LEED® certified buildings are typically *not designed for the environment to have lower impacts on them*. Damage and loss of use for LEED®-rated buildings in Hurricane Sandy was significant.

The USGBC have recently adopted three pilot resilience points to address this important issue. Design and construct buildings that can resist, with minimal damage, reasonably expected natural disasters and weather events (i.e. flooding, hurricanes, tornadoes/high winds, earthquakes, tsunamis, drought, and wildfires).

The USRC is in discussions with USGBC to have a Silver level USRC Rating (three stars safety, four stars damage, and three stars recovery) approved as one of their pilot resilience points. The USGBC have appointed a new committee to address the resilience points. The Redi Silver Rating has been approved by USGBC for one resilience point and thus the USRC Silver Rating (three, four, three star across the three dimensions) is equivalent to the Redi rating provided the FEMA P58 methodology is used. We are also in discussions with Green Globes to have them recognize a USRC rating for resilience.

### **Potential Applications and Outreach Goals of the USRC**

The greatest value of a rating system is one that meshes with economic decisions. Thus, there are a number of potential applications with an important one being a building rating that is disclosed as part of a real estate sales transaction. As the system achieves increasing acceptance, mortgage lenders could potentially use it in the way they currently use Probable Maximum Losses (PMLs). In the context of a sales transaction, we envision that market pressures would encourage buyers and/or sellers to obtain a rating, making it part of pre-purchase due diligence. A related situation which could initiate a rating to be obtained is a lease turnover. Examples of this market mechanism include the Building Owners and Managers Association (BOMA) rating system for office space (Class A, B, C). In addition, both the Federal and State General Services Administration (GSA, DGS) may require a rating to be obtained as a means of prioritizing the buildings they lease, and the USGBC could use it as part of sustainability criteria. The outreach goals of the USRC follow:

**Goal 1 - *USRC Ratings as part of a real estate transaction and an eventual replacement for a PML.***

**Goal 2 - *Use of the USRC rating system to establish relevant design objectives rather than accepting a code designed building.***

**Goal 3 - *Motivate owners of existing high performance buildings to get a USRC rating.***

**Goal 4 - *Encourage entities that have rating systems to use the USRC system.***

**Goal 5 - *Encourage the requirement of a rating with a building permit for new construction and major retrofits.***

- The long-term resilience of our communities needs to begin as soon as practicable. One positive step state and local jurisdictions can take is to require the submittal of a USRC verified rating as a part of the permit process for new construction. This will begin to develop a database of information for a city to understand how its building stock can be expected to perform.

**Goal 6 - Promote Greater Awareness of the Rating System in the Architectural Community.**

- Architects advise on hundreds of decisions, large and small, that affect not just sustainability but also disaster performance and recovery. Architects have the power to guide clients in understanding the issues and making informed design decisions. Structural engineers have developed credible ways to predict building earthquake performance and can help design for better and more reliable performance in cost effective ways. Working together, design teams can achieve the client's desired performance for structural, architectural, and MEP components.

**Goal 7 - Create awareness for building owners (BOMA), tenants, and lease's to create a bottom-up demand for ratings**

## Conclusions

The creation of the U.S. Resiliency Council comes at a time when the federal government has recognized the need for long-term resiliency planning of its infrastructure, critical facilities, and communities. The steadily increasing economic and social losses in U.S. disasters, and the awareness of the potential effects of catastrophic events on an increasingly dense and unprepared population, are a clear call for more consistently-applied assessment techniques to measure building resiliency.

The financial and real estate sector is under scrutiny in terms of its ability to assess risk and measure the quality of its assets. Existing risk quantification metrics are subject to real or perceived distortion and manipulation within the marketplace. The deficiencies with the current state of the PML process have been catalogued with a significant concern being the common use by both engineers and non-engineers of methods that do not have a sound technical basis, and the “gaming” of the methods to achieve a PML beneath the required threshold.

The USRC offers a technically defensible and replicable methodology for implementing a consistent and measurable rating system. Ratings will build upon existing technical standards and cover a range of natural and man-made hazards. The USRC will provide accreditation, training and peer review, and either verified or transaction ratings that will be usable by both the public and private sector, by building owners and occupants, for financial and safety assessments.

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