Earthquake Engineering Research Institute
Utah Chapter
Fall 2016 Newsletter

The Future of Resilience

By Ron Dunn
EERI Utah Chapter President

This year the Utah Chapter is placing increased emphasis on Resiliency. Part of this emphasis is reaching out to the non-technical community and informing them of the many benefits of resilient design and how it can affect them.

Over the years I have written several articles to readers who may engage the services of a structural engineer. These articles have been focused primarily on value, trust, return on investment, constructability, and service. In each case I point out an interesting fact about the professional services a structural engineer provides. Architects and engineers have a fiduciary responsibility not only to their clients who pay their bills, but also to the public at large who gather, visit or work in each building. The return on the original developer's investment may not be the best return on the visitor's, renter's or future purchaser's investment. Economics can sometimes trump the best overall return. Chances are the structure you reside in, rent or intend to purchase may not collapse during a seismic event; however, it just may be rendered unsafe to re-occupy for a period of time. How would this time period affect you personally, your business, or your job security as an employee?

Structural engineers often feel we can do much more if we were only permitted to do so. We know better ways to protect both the contents and occupants as well as the structure itself. Allow me to pose this question: If an airbag were a financial option when you purchased a car, how many would elect to add this option to the bottom line? None of us ever expect or intend to be in an accident where this device may be required. As a potential second buyer of the car, would this effect your decision? Building a substandard, yet "code compliant" structure may very well result in an economic loss at the time of a sale. Just because the building received a building permit does not automatically validate that the design will perform to the occupant's desire.

Structural Engineers use as a basis of design a seismic force generated by an earthquake that has a recurrence interval of two percent in 50 years, or a 2,500 year repeat cycle. This formula determines how much a building must resist in order for the occupants to get out alive. This does not insinuate that there will not be significant damage to the structure that prohibits re-entry. Most engineers are confident very few lives will be lost as a result of such an event; however, they are also confident there will be a significant number of structures damaged beyond repair or requiring significant repair.

We design for life safety, but the quality of life we may be faced with after an earthquake is not part of any design process. The inability of people to return to their jobs, schools or homes is much more difficult to financially quantify. This can greatly affect the quality of life and impact communities for years and even decades! Recent research has also estimated the financial losses for new code-designed buildings subjected to "code design level" shaking to be higher than 20 percent of total replacement value, and the expectation is that they may be unusable for more than one year. Numerous published articles have indicated that the amount of energy required to clean up, repair, replace and re-occupy damaged buildings during an average seismic event far exceed the total energy use for one year for the same region. That is to say that the amount of energy and carbon footprint used to clean up Salt Lake City after a moderate event would exceed the total energy used by this city in one year! Not to mention the disruptive experience of it all.

There is a better way! In the near future you may see buildings (new and used) rated on a normalized scale measuring safety rating, repair cost rating and functional recovery time rating. *Resilience*-based earthquake design is a holistic process that identifies and mitigates earthquake-induced risks which can enable a more rapid overall recovery after a catastrophic event. This process implements multi-disciplinary design and planning and is ultimately identified with a consistent non-biased rating system.

Structural engineers can significantly increase your odds of managing the risk in your favor through creative design. Code minimums are just that: minimums. Through *resilience*-based design you will see some changes as to

how we feel about the structural integrity of the buildings we occupy. Current building codes do not focus or even address earthquake *resilience*, or the ability of a community to recover after a larger seismic event. Still a rather foreign term, *resilience* will soon affect financial consequences and influence expectations of how we treat real estate. Fully understanding the consequences of significant financial losses associated with business downtime will soon help motivate business owners to consider the importance of *resilient* design. This will be even more evident in the resale of property.

Soon, the anticipated performance (or *resilience*) of structures will influence where we desire to work and perhaps live. Would a marginal increase in rent sway your decision if it meant you could occupy your building and provide continuous employment to your employees soon after a seismic event? In truth, for a minimal additional effort, higher performance buildings can be designed and constructed to not only protect our economic future but provide a safe refuge and increased peace of mind while in the workplace. All of this while significantly contributing to the future reduction of energy costs. The future will soon be here.

Utah Earthquake Resiliency Workshop Recap

By Brent Maxfield
EERI Utah Chapter Past President

The Utah Earthquake Resiliency Workshop brought together more than 120 interested individuals to discuss the issues related to preparing for and recovering from an earthquake in Utah. The Workshop was held on April 27, 2016 at the Veridian Event Center.

Chris Poland, a world renowned authority on earthquake engineering and a campion of disaster resilience discussed the need for communities to understand their risks and to then determine objectives and set short-term and long-term goals to ensure that important services can be restored within a desired period of time. He presented the newly released NIST *Community Resilience Planning Guide for Building and Infrastructure Systems*, and discussed how communities can use this Guide for their resilience planning efforts.

The day was filled with panel discussions comprised of local experts on the following topics:

- Earthquakes: Public Perception vs. Reality
- The Critical Three: Schools, Housing, & Jobs
- Utah's Economic Resilience: Getting the Wheels Rolling
- State Healthcare Resiliency Efforts: What Can We Learn?
- Public Works and Lifelines: Understanding the Interdependencies
- Role of Government: Mitigation Efforts & Recovery Expectations

Kent Yu, who chaired the effort to create the Oregon Resilience Plan, then spoke about his experience in assembling and working with a diverse group of experts to develop the plan. His presentation was an excellent example of how Utah could develop a similar plan.

The day concluded with a panel comprised of leaders from many of the state's professional organizations, the USSC, as well as state and county representatives. These individuals were chosen because their position within their organizations would allow them to lead change and help drive the resiliency efforts within the state of Utah. Several goals were set. (Note: As a result of this panel, the USSC has discussed the effort and is in the process of helping to formalize the effort to create a Utah Resiliency Plan.)

A 267-page workbook with slides from various presenters is available on the EERI Utah website: https://utah.eeri.org/?p=477. If you attended, or did not attend, I encourage you to download the workbook to learn from what was presented at the Workshop.

The Workshop helped each attendee understand the issues related to resiliency that are outside of their normal circle of influence. Community Resilience is truly an interdependent multidisciplinary effort. That is what makes EERI such an excellent organization to help with the effort. Please consider joining the EERI Utah Chapter to show your commitment to helping us reduce the harmful effects of earthquakes in Utah.

Let's Build Bridges

By Jerod Johnson
EERI Utah Chapter Past Board Member

January of this year marked the conclusion of my service on the Board of Directors for the Utah Chapter of EERI. It was wonderful to have the opportunity to interact with so many individuals with whom I share common interest. I have also been heartened to see, despite so many in our midst who choose to have their heads in the sand regarding the seismic threat, that there are large numbers of groups and individuals who appreciate the seismic threat for what it is. These are conscientious people who are dedicated to the perseveration of lives and preservation of society.

While on the EERI Utah Chapter Board of Directors, I also served as President and a member of the board of directors of SEAU, the Structural Engineers Association of Utah. It's no secret that my invitation to be on the EERI Board was due, in part, to my involvement with SEAU and the EERI Directors saw an opportunity to forge a strong alliance between the two organizations. It pleases me to report that this objective was realized and that both organizations are realizing a strong mutual advantage through collaborative efforts. The joint EERI/SEAU Fall Seminar is now a standing event, bringing together the combined efforts of SEAU and EERI to provide an outstanding opportunity for growth and learning. As I now look what may lie ahead, I hope that other such alliances may be forged and that even more individuals may be counted among the beneficiaries of offerings of EERI and partnering associations. As such alliances are considered, it clearly behooves EERI to consider affiliated organizations of common relevance and purpose. Indeed, any organization seeking to advance and preserve the human condition is worthy of such alliance.

Organizations dedicated to the advancement and preservation of the human condition are countless and the resources of EERI and its members clearly cannot forge connections with every relevant organization. However, many are clearly worthy candidates with goals and missions consistent with those of EERI. ASCE has been established for over 160 years and represents perhaps the largest and most diverse of all engineering disciplines. Indeed, the standards structural engineers use on a daily basis governing the design of structures bear the ASCE moniker. The Utah Sections of ASCE clearly share a common interest with EERI. The Utah Chapter of EERI hopes to 'Build Bridges', as it were, with ASCE and other non-profit societies and organizations seeking to advance, protect and preserve the human condition. That so many different engineering societies have emerged since the founding of ASCE is indicative of the advancement of the engineering profession. Were such advancements not the reality, we would not be witness to such stark contrasts as that demonstrated between San Francisco, 1906 and Nisqually, 2001. For the former, records hold a loss of more than 3,400 lives and for the latter, reported deaths reach only one…and this was apparently due to a stress-related heart attack. Arguments are even made that the economic fallout of the 1906 event are still felt to this day as Los Angeles assumed the role as mecca for West-Coast Commerce in the aftermath of the Great San Francisco Quake.

We cannot begin to quantify lives that may be affected by the earthquake threat. Likewise, we cannot begin to enumerate the professions, societies, governments and many other organizations holding a stake in the seismic discussion. On that note, my hopes for the Utah Chapter of EERI include a vision of a well-connected network of professionals, researchers, advocates, owners and public policy makers all of whom have a well-developed appreciation of the seismic threat and a drive to embrace collaborative efforts that will save lives, improve societies and enable highly resilient communities.

Upcoming Events:

EERI 2016 Distinguished Lecture, Thursday September 8, 2016

FROM PERFORMANCE-BASED ENGINEERING TO EARTHQUAKE RESILIENCE

By: Gregory Deierlein, J.A. Blume Professor of Engineering, Stanford University

Performance-based earthquake engineering has matured over the past twenty years from a conceptual framework into a formal methodology that can enable quantitative assessment of the seismic risks to buildings and infrastructure. Enabled by advanced nonlinear analysis, performance-based methods provide for more transparent design and decision making that takes advantage of the latest research in characterizing earthquake ground motion hazards, simulating structural behavior, and assessing earthquake damage and its consequences. Performance-based approaches are facilitating the design of innovative structures and influencing building code requirements and public policies for earthquake safety. Yet, many challenges remain to evaluate recovery from earthquake damage and implications on the socio-economic functions of society. This talk will examine the major developments in performance-based earthquake engineering and ways it can be applied to reduce earthquake risks and improve earthquake resilience.

See the last page of this newsletter for the event flier.

EERI National Elections

The 2017 EERI board election will include two of our own Chapter members on the ballot: Brent A. Maxfield and Barry H. Welliver! EERI Members vote for their candidates from October 1, 2016 to November 1, 2016. All of the candidates' biographies and vision statements can be found at https://www.eeri.org/2016/08/2017-eeri-board-election-meet-the-candidates/.

Announcing the SEAU/EERI Utah Resiliency Committee

Advancements in recent decades in prescriptive measures for seismic resistant design have yielded major life safety improvements for significant earthquakes. Recent earthquakes and other natural disasters have demonstrated that preserving life is simply not enough. Emergency planners, governments and communities have come to know that the ability to quickly recover, preserve property, preserve jobs, and resume economic growth are paramount issues. Lack of resilient infrastructure can mean financial ruin and can have devastating impacts on communities with lasting effects.

The Boards of the Structural Engineers Association of Utah (SEAU) and the Utah Chapter of the Earthquake Engineering Research Institute (EERI) have approved the formation of an ad-hoc joint committee on resilience. This committee will seek participation and membership from both organizations. We will work to:

- Develop an outreach strategy to building officials, owners, developers, designers, other stakeholders and non-profit organizations with similar interests to establish a dialogue and find the common ground that will most effectively advance resiliency of the built environment.
- Develop educational campaigns to engineers, architects, planners, building officials, and others to raise awareness of building code objectives and highlight the benefits of considering resiliency issues when building, upgrading, purchasing, or renting a building.
- Improve public understanding of:
    - Expected building performance of a new structure designed to current codes
    - Assessment of building resiliency with FEMA P-58 and USRC Ratings
    - Enhancement of new construction and of existing structures for seismic resiliency.
- Serve as a local liaison to the United States Resiliency Council (USRC) to promote building ratings to engineers, architects, and owners as a meaningful metric for assessing resilience of an individual building.

- Work jointly with SEAU, EERI and other organizations of similar focus to provide educational opportunities for engineers, designers, students, and others to learn methodologies for measuring resilience.
- Under the direction of the SEAU Board, coordinate with other SEAU committees to synergize efforts (and prevent duplicate efforts) for resiliency
- Assist the Utah Seismic Safety Commission (USSC) with assigned tasks to support the mission of the USSC.

If you are interested in participating, please contact the committee chair, Jessica Chappell, at jchappell@reaveley.com.

EERI Utah Chapter Elections

The election took place in December of 2015. The following individuals were elected:
Jim Nordquist, Vice President / President Elect
Luis Ibarra, Secretary / Treasurer
Rob Snow, Board Member

2016 EERI Utah Chapter Leadership			
President	Ron Dunn	rdunn@dunn-se.com	(801) 575-8877
Vice President / President Elect	Jim Nordquist	nord@agecinc.com	(801) 566-6399
Secretary/Treasurer	Luis Ibarra	luis.ibarra@utah.edu	(801) 585-9307
Past President	Brent Maxfield	maxfieldba@ldschurch.org	(801) 240-1529
Board Member	Bob Carey	bcarey@utah.gov	(801) 538-3784
Board Member	Bill Lund	billlund@utah.gov	(435) 865-9034
Board Member	Rob Snow	robert.w.snow@aecom.com	(801) 904-4000

Helpful Earthquake Engineering Links:

Earthquake Engineering Research Institute (EERI) - Utah	http://utah.eeri.org
National EERI	http://www.eeri.org
Structural Engineering Association of Utah (SEAU)	http://www.seau.org
American Society of Civil Engineers (ASCE) – Utah	http://www.sections.asce.org/utah/
ASCE GEO-Institute	http://www.asce.org/geo/
American Council of Engineering Companies (ACEC) - Utah	http://www.acecutah.org
Seismological Society of America (SSA)	http://www.seismosoc.org
Southern California Earthquake Center (SCEC)	http://www.scec.org
Utah Seismic Safety Commission (USSC)	http://ussc.utah.gov
Utah Geological Survey (UGS)	www.geology.utah.gov/utahgeo/hazards/index.htm
University of Utah Seismology and Active Tectonics Research Group	http://www.uusatrg.utah.edu
Utah Division of Occupational and Professional Licensure (DOPL)	http://www.dopl.utah.gov
United States Geological Society (USGS)	http://earthquake.usgs.gov/
Be Ready Utah	http://www.utah.gov/beready/
Utah ShakeOut Website:	http://www.shakeout.org/utah/
Homebuyer's Guide to Earthquake Hazards in Utah	http://geology.utah.gov/online/pdf/pi-38.pdf

If you are not a current member of the EERI Utah Chapter, it only costs $25 per year to join. You can join by following the links at http://utah.eeri.org.

EERI Utah Chapter is seeking articles and announcements for upcoming newsletter editions. Please forward submissions to be considered by the Utah Chapter leadership to Jessica Chappell at jchappell@reaveley.com.

EERI 2016 DISTINGUISHED LECTURE

THURSDAY, SEPT. 8, 2016

LECTURE
6:00 – 7:30 PM

SOCIAL EVENT AT 5:30 PM
REFRESHMENTS WILL BE SERVED

LOCATION: MEK-3550
KENNECOTT BUILDING
UNIVERSITY OF UTAH

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EERI UTAH CHAPTER

Department of Civil & Environmental Engineering
THE UNIVERSITY OF UTAH

Greg Deierlein is the John A. Blume Professor of Engineering in the Department of Civil & Environmental Engineering at Stanford University where he directs the Blume Earthquake Engineering Center. He holds a doctorate from the University of Texas at Austin, a master of science from the University of California at Berkeley, and a bachelor of science from Cornell University. Greg previously served as the deputy director for the Pacific Earthquake Engineering Research (PEER) Center where he led the research planning to develop performance-based approaches and technologies in earthquake engineering. Deierlein specializes in the design and behavior of steel, concrete and composite structures, nonlinear structural analysis, computational fracture and damage mechanics, and performance-based earthquake engineering. He is a registered professional engineer and maintains professional activities as a structural engineering consultant, design peer reviewer, and participant in national technical and building code standards committees. In 2013, he was elected to the US National Academy of Engineering for his contributions to applying nonlinear analysis in structural design.

STUDENTS, ENGINEERS, ARCHITECTS, AND PLANNERS ARE ENCOURAGED TO ATTEND

1.5 PDH WILL BE OFFERED