

2017 ANNUAL REPORT

Utah Chapter

of the Earthquake Engineering Research Institute

Report Date: February 13, 2017

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Chapter Logo or
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This report summarizes the membership and activities conducted by the Utah Regional Chapter of the Earthquake Engineering Research Institute during 2017.

MISSION & GOALS

The Utah Chapter was chartered in 2012 and continues to gain momentum and provide meaningful opportunities for professional growth and increase public awareness. The Utah Chapter Mission continues to mirror the overall Mission Statement of EERI National. The three main objectives of this Mission Statement gave us direction while setting Goals and identifying areas where we as a local chapter can make an impact in the Utah Region. Some of these Goals are summarized herein:

- Recognize that 2015 Goals were well thought out and continue to champion their cause. (refer to 2015 Annual Report)
- Increase local membership by 15%. Encourage non-professional participation. Increase younger-member through recruitment of near graduates
- Host the 2016 EERI Distinguished Lecture
- Hold short course on Resiliency
- Co-sponsor a joint meeting with SEAU (Structural Engineers Association of Utah)
- Implement the EERI SLC segment earthquake scenario-adopt as the scenario for the 2016 Great Utah Shakeout Exercise
- Develop (continue) a cooperative and working relationship with ASCE, SEAU and SEI Chapters
- Assist other groups in helping to make the State more earthquake resilient
- Increase the awareness of the impacts of a magnitude 7 earthquake along the Wasatch Front.
- Promote cross-discipline education between the diverse members of EERI to inform and focus a large group of professionals across the intermountain region
- RESILIENCY will be the underlying focus

MEMBERSHIP SUMMARY

The Utah Regional Chapter had a total of 42 members in 2016.

OFFICERS

The Board consisted of the following members:

Role	Name	Affiliation	Email
President	Ronald Dunn	Dunn Associates, Inc.	RDunn@dunn-se.com
Secretary-Treasurer	Luis Ibarra	University of Utah, Structural Faculty	Luis.ibarra@utah.edu

Utah Earthquake Resiliency Workshop – April 27, 2016

This workshop was a jamb packed day in which Guest Speakers present current understandings on Resiliency. There were also 5 different Panel Discussions with local experts forming the panels.

Guest Lecturers included:

- Chris D. Poland, SE, NAE – Consulting Engineer Earthquake and Disaster Resilience
- Kent Yu, PhD, SE – SEFT Consulting Group
- Judith Mitrani-Reiser, PhD – John Hopkins University

200+ were in attendance.

Flyer attached

EERI 2016 Distinguished Lecture – Greg Deierlein, PhD. September 8, 2016

We were fortunate to schedule the EERI 2016 Distinguished Lecture. Greg Deierlein was an associate to Luis Ibarra, (current Board Member) and this became a special event. The event was held on the campus of the University of Utah.

Attendance of over 80.

Flyer attached

EERI / SEAU Joint Meeting – Resiliency – October 20, 2016

In support of our joint effort to promote public awareness and to better educate the professional design community, an evening joint meeting was held. This was very successful in encouraging the design professionals to better educate their clients.

90 were in attendance

COMMUNICATIONS

With the recent improvements to the web site we were able to utilize this avenue for social as well as business reasons. We inserted our local logo on all publications this year to help define our brand. Can improve.

We have a functioning Newsletter Committee and were able to publish a few newsletters. I believe that we also can improve this level of communication. A sample newsletter is attached.

STUDENT CHAPTER COORDINATION

There is a strong reason to believe that a Student Chapter at the University of Utah may be established this year. The momentum for this gained strength towards the end of the year. Until then the students at the U of U are encouraged to join the Utah Chapter.

Brigham Young University currently has a student chapter. The Utah Chapter is a supporter of the BYU Chapter and request they participate in our events.

As a Board, we have attempted to include on the Board those who have close association with each Student affiliation.

Past President	Brent Maxfield	The Church of Jesus Christ of Latter Day Saints, Special Projects	maxfieldba@ldschurch.org
President Elect	James Nordquist	Applied Geotechnical Engineering Consultants, Inc.	nord@agecinc.com
Director	Bill Lund	Utah Geological Survey (Retired)	Williamlundugs.com
Director	Bob Carey	Utah Division of Emergency Management	bcarey@utah.gov
Director	Rob Snow	URS	Robert.w.snow@urs.com

Board meetings were held on a monthly basis at 5:00 pm the first Wednesday of each month. These meetings were held in the offices of Dunn Associates, 380 W. 800 S. SLC, Utah. Members who are located out of the region or absent for any reason were connected via tele/video conference.

BUDGET & FINANCIALS

Year-end financial are attached herein. Modest registration fees associated with the several sponsorships for events that were held contributed to the operating resources. The focus was to enable world class events.

CHAPTER ACTIVITIES

With the major focus this year on Resiliency our scheduled events supported this topic.

Capitalizing on the successful publication of the "*Scenario for a Magnitude 7.0 Earthquake on the Wasatch Fault – Salt Lake City Segment: Hazards and Loss Estimates*" during the 2015 Calendar Year, we continued to reach out to the non-professional community to promote public awareness.

Also during this year the USGS announced during the State Seismic Safety Commission Meeting their revised probability analysis for a major event along the Wasatch Fault. This analysis significantly increase the probability in this important region. This announcement was accompanied with a news press conference. As a result of this meeting it was determined that a Resiliency Committee be formed. This Committee was eventually broken into expertise groups for which EERI is currently taking an active role.

REGULAR CHAPTER MEETINGS

The Utah Chapter does not have regularly scheduled Chapter meetings. Via newsletters and regularly scheduled events/lectures we feel our membership is well informed. This is an idea that would become valuable as our membership increases.

SEAU Educational Conference – February 23-24, 2016

Annually, SEAU invites outside instructors to come for 2 days for technical instruction. EERI requested to participate and was allowed to man a booth in which we distributed the Scenario Document, invited membership and responded to general questions. It was also an opportunity for EERI Utah President to make a public announcement to over 200 present. This was a good opportunity for the Scenario Document to be placed into hands of local Professional Engineers and to encourage enrolment in EERI.

EERI Annual Meeting – San Francisco, CA April 5-8, 2016

4 members of the Utah Chapter, including; President, Past-President, Director and other members were in attendance. The President attended the special breakout session with other Chapter Presidents. Highlights of this conference was communicated to the Board and other members.

ELECTION & ELECTION RESULTS

An election for officers was held during January 2017. The table below shows the new officers appointed to the Chapter board who will take office on January 2017.

Role	Name	Affiliation	Email
President Elect	Chris Garris	Consolidated Engineering Laboratories	garrisct@pbworld.com
Director	Steve Bowman	Utah Geologic Survey	stevebowman@utah.gov

2017 GOALS

Under separate cover. To be determined by new leadership.

LIST OF ATTACHMENTS

Included at the end of this report are various attachments to supplement the information included above. A list of the attachments is included below:

- Item 1, USGS / USSC Probability Announcement
- Item 2, Utah Resiliency Workshop
- Item 3, Distinguished Lecture
- Item 4, Sample Newsletter

Insert any pdfs of these documents in your final report. (attached)



ITEM 1

USGS / USSC Probability Announcement

Earthquake Forecast for the Wasatch Front Region of the Intermountain West

The Working Group on Utah Earthquake Probabilities (WGUEP) has assessed the probability of large earthquakes in the Wasatch Front region. There is a 43 percent probability of one or more magnitude (M) 6.75 or greater earthquakes and a 57 percent probability of one or more M6.0 or greater earthquakes in the region in the next 50 years. These results highlight the threat of large earthquakes in the region.

The spectacular relief of the Wasatch Front is the product of earthquake-generating fault movement. In this region, large earthquakes are likely to occur on faults that extend along the base of mountain ranges such as the Wasatch Range. The Wasatch fault zone is the longest, most active, and most hazardous fault in the region. Movement on this fault has created valleys, like the Salt Lake and Utah Valleys, which contain the modern Wasatch Front urban corridor. The Wasatch fault zone borders and in some places crosses through this corridor, which is home to nearly 80 percent of Utah's population of 3 million and more than 75 percent of Utah's economy.

Wasatch Front Region Earthquake Forecast

In the first comprehensive study of its kind in the Intermountain West, the WGUEP has assessed the likelihood of large earthquakes in the Wasatch Front region (WGUEP, in press) (fig. 1). This forecast conveys the probability of one or more earthquakes of a specified magnitude range in the region in the next 50 years, similar to how a meteorologist might describe a chance of rain within a geographic region during the next few hours. The resulting earthquake probabilities are useful for seismic hazard analyses and can help inform the development of public policies leading to effective earthquake loss-reduction efforts.

Earthquake Probabilities for the Wasatch Front Region

	M6.0 or greater	M6.75 or greater
Wasatch fault zone	18%	18%
Oquirrh-Great Salt Lake fault zone	7%	6%
Other faults in the region ¹	34%	25%
Background earthquakes	14%	NA ²
Wasatch Front region total	57%	43%

Probabilities are for one or more earthquakes in the next 50 years (WGUEP, in press).

¹Combined probability for the 45 other faults or fault sections in the region.

²Probability not calculated for background earthquakes.

There is a 43 percent probability that the Wasatch Front region will experience at least one M6.75 or greater earthquake in the next 50 years. This total probability for the region is based on new geologic information on the timing and location of large prehistoric earthquakes on known faults in the region (fig. 2). For example, investigations of the Wasatch fault zone indicate that at least 22 large prehistoric earthquakes have ruptured parts of this fault between Brigham City and Nephi in the last 6,000 years (WGUEP, in press). The probability of at least one M6.75 or greater earthquake on the Wasatch fault zone is 18 percent in the next 50 years. The forecast

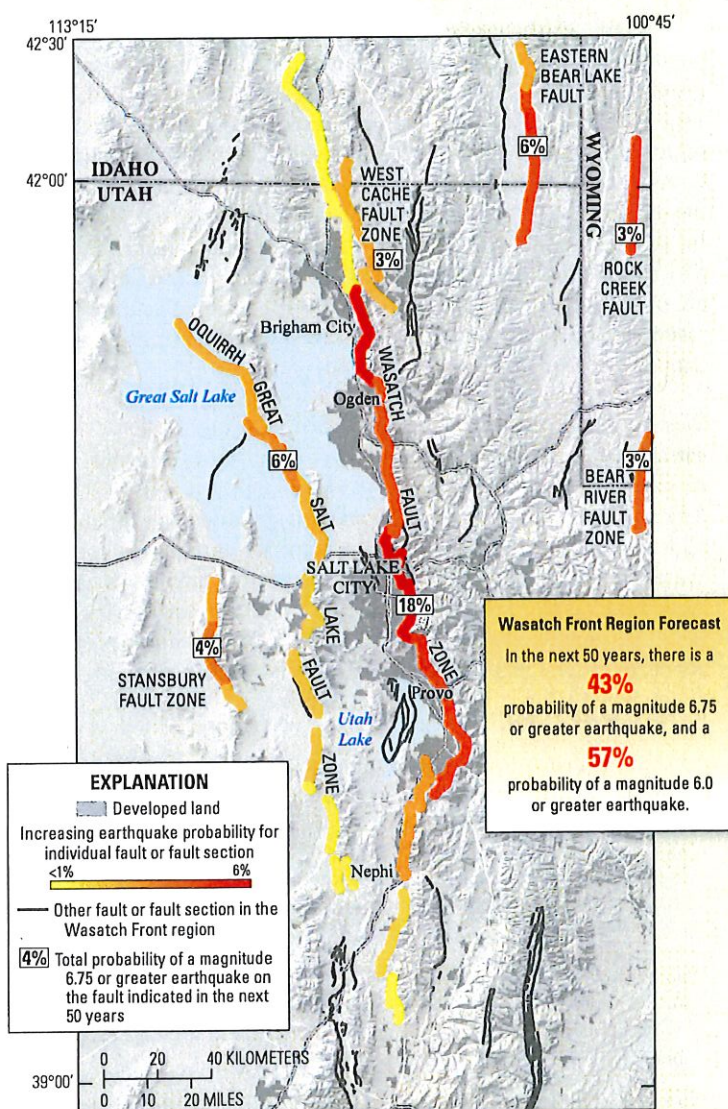


Figure 1. Magnitude 6.75 or greater earthquake probabilities may vary along faults (yellow to red fault colors), but entire fault probabilities are labeled. For example, the total probability for the entire Wasatch fault is 18 percent. Only faults with a probability of 2 percent or greater are shown. Modified from Working Group on Utah Earthquake Probabilities (in press). (% , percent)

also incorporates information for 45 other faults or fault sections in the region that are capable of generating large earthquakes. The probability of one or more M6.75 or greater earthquakes on the other faults or fault sections is 25 percent in the next 50 years.

There is a 57 percent probability of one or more M6.0 or greater earthquakes in the region in the next 50 years. This total earthquake probability is based on the probability of M6.0 or greater earthquakes on known faults and a reevaluation of the size of historical quakes that have occurred since the settlement of the region (fig. 2). Historical quakes are used to evaluate the potential for more moderate, M5.0 to 6.75 earthquakes in the region (known as background earthquakes) that are not associated with known faults. There is a 14 percent probability of a M6.0 or greater background earthquake in the next 50 years.

Consequences of Future Earthquakes

A large earthquake could have long-lasting effects on the population, infrastructure, and economic stability of the Wasatch Front region. For example, a large quake on the Wasatch fault zone near Salt Lake City could have an enormous impact on the region and result in 2,000 to 2,500 fatalities; 7,400 to 9,300 life-threatening injuries; 84,000 families displaced from their homes; the disruption of lifelines like water, electricity, gas, and sewer for days to months; and a total short-term economic loss of over \$33 billion (Pankow and others, 2015). Although some faults are in undeveloped parts of the region, earthquake effects are far reaching, and a large earthquake on one of these faults could also damage and disrupt the Wasatch Front urban corridor.

These probability calculations are a reminder that the Wasatch Front region is seismically active and that large earthquakes can occur at any time. Over time, these probability calculations may be refined as new geologic and seismic data are developed and our understanding of earthquakes in the region improves. However, the threat of large earthquakes in the Wasatch Front region remains clear. As a result, individuals can take measures to be prepared and reduce their earthquake risk (Utah Seismic Safety Commission, 2008), and communities can advocate for resilient earthquake design and disaster planning.

References Cited

- Pankow, Kristine; Arabasz, Walter; Carey, Robert; Christenson, Gary; Groeneveld, Josh; Maxfield, Brent; McDonough, Peter; Welliver, Barry; and Youd, T.L., 2015, Scenario for a magnitude 7.0 earthquake on the Wasatch Fault—Salt Lake City segment: Utah Chapter, Earthquake Engineering Research Institute, 53 p., accessed March 10, 2016, at <https://ussc.utah.gov/pages/help.php?section=EERI+Salt+Lake+City+M7+Earthquake+Scenario>.
- Utah Seismic Safety Commission, 2008, Putting down roots in earthquake country—Your handbook for earthquakes in Utah: Utah Seismic Safety Commission, 34 p. [Also available at www.utah.gov/beready/family/documents/puttingDownRoots.pdf.]
- Working Group on Utah Earthquake Probabilities (WGUEP), in press, Earthquake probabilities for the Wasatch front region in Utah, Idaho, and Wyoming: Salt Lake City, Utah Geological Survey Miscellaneous Publication 16–3, 520 p.

Acknowledgments

Working Group on Utah Earthquake Probabilities (WGUEP) members include Ivan Wong (URS Corporation [URS]), William Lund (Utah Geological Survey [UGS]), Christopher DuRoss (UGS, currently U.S. Geological Survey [USGS]), Patricia Thomas (URS), Walter Arabasz (University of Utah Seismograph Stations [UOSS]), Anthony Crone (USGS), Michael Hylland (UGS), Nicolas Luco (USGS), Susan Olig (URS), James Pechmann (UOSS), Steve Personius (USGS), Mark Petersen (USGS), David Schwartz (USGS), and Robert Smith (University of Utah). The Wasatch Front region earthquake forecast was supported by the USGS National Earthquake Hazards Reduction Program, UGS, and URS.

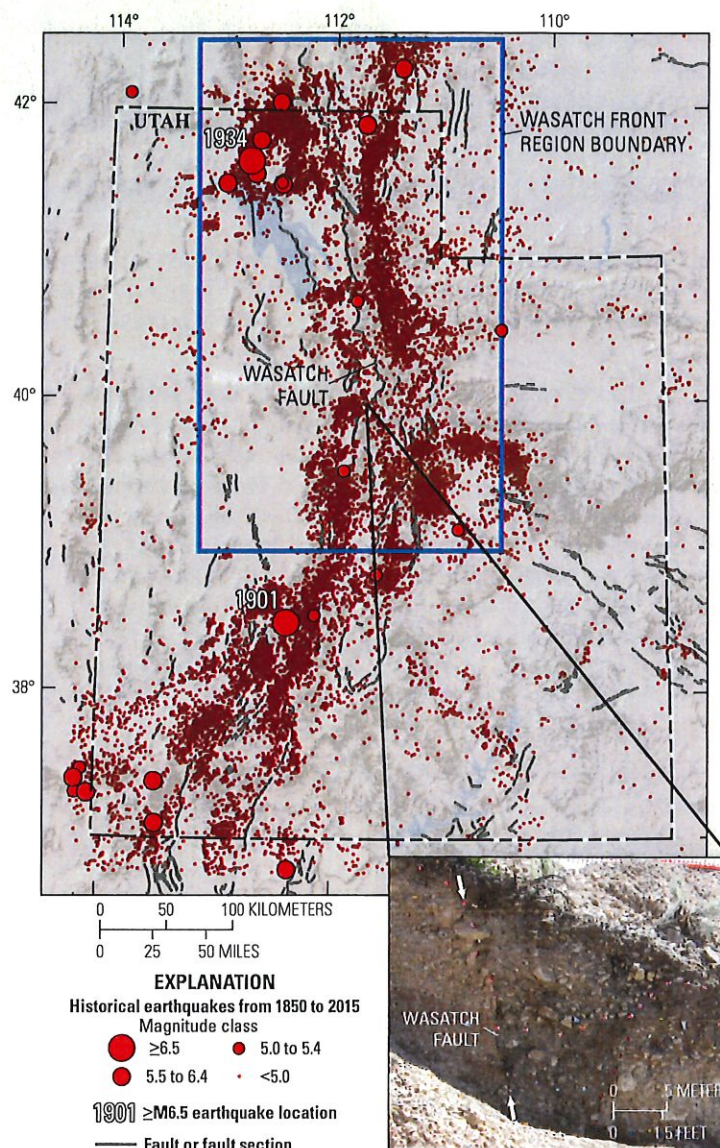


Figure 2. Historical earthquakes observed in Utah and surrounding states between 1850 and June 2015 (Working Group on Utah Earthquake Probabilities, in press). This record is used to evaluate the potential for magnitude 5.0 to 6.75 earthquakes in the region. Inset image shows geologic investigation of a large (approximately magnitude 6.75 or greater) prehistoric earthquake on the Wasatch fault near Santaquin, Utah. Arrows indicate evidence of faulting in geologic layers exposed near the ground surface.

For Further Information

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Utah Geological Survey



FOR IMMEDIATE RELEASE

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**New Report Forecasts the High Likelihood of Damaging Earthquakes
During the Lifetime of Many Utah Residents**

Salt Lake City (April 18, 2016) — In the first comprehensive study of its kind for Utah, *Earthquake Probabilities for the Wasatch Front Region in Utah, Idaho, and Wyoming* forecasts the chances for damaging earthquakes in the Wasatch Front region. In the next 50 years there is a 43 percent chance, or nearly 1-out-of-2 odds, of at least one large earthquake of magnitude 6.75 or greater. For a moderate quake of magnitude 5 or greater the probability is 93 percent, or greater than 9-out-of-10 odds.

“Considering that the average age of Utah’s citizens is the youngest in the nation at about 29 years, there is a realistic chance that many current residents will experience a large earthquake in their lifetime,” says Ivan Wong, Principal Seismologist at Lettis Consultants International and lead author of the report.

The soon-to-be-released report is a collaboration of 14 scientists from academia, federal and state agencies, and private industry. The results underscore the importance of being prepared for damaging earthquakes in Utah.

Scientists cannot predict exactly when and where an earthquake will occur and thus rely on forecasts to convey the chances of future quakes. Similar to weather forecasts, earthquake forecasts give the probability that an earthquake of a specific magnitude will occur within a specific region within a particular time period.

The new report forecasts quakes within the Wasatch Front region, where nearly 80 percent of Utah’s population resides. The report covers time periods significant to an individual’s lifetime of 30, 50, and 100 years, and addresses earthquakes strong enough to potentially cause significant to catastrophic damage, magnitude 5 up to about 7.5. Even a moderate quake of magnitude 5 can cause considerable damage such as fallen plaster and broken chimneys, but a large quake of magnitude 6.75 or greater can cause catastrophic damage, including collapse, to structures such as unreinforced masonry (brick) buildings.

The well-known Wasatch fault is the most likely fault in the region to generate a large earthquake, having an 18 percent probability of at least one earthquake of magnitude 6.75 or greater in the next 50 years. However, the new report highlights many other mapped and even unmapped faults that contribute to the chances of an earthquake. When considered together, these many faults significantly increase the regional probabilities of an earthquake.





Utah Department of Natural Resources Utah Geological Survey



Utah residents have several resources available to help them with earthquake preparedness. The annual Great Utah Shakeout is Utah's largest earthquake drill. Nearly 1 million people are expected to participate in this year's drill on April 21st. For more information and to sign up see shakeout.org/utah.

Be Ready Utah, the state's emergency preparedness program run by the Division of Emergency Management, shares information about earthquakes and other hazards on its website, BeReadyUtah.gov, and everywhere on social media.

The Utah Seismic Safety Commission publication *Putting Down Roots in Earthquake Country—Your Handbook for Earthquakes in Utah* gives information on earthquake hazards and preparedness, and is available at www.utah.gov/beready/documents/roots_earthquake_low.pdf.

The Earthquake and Engineering Research Institute, Utah Chapter, recently published a report describing hazards and loss estimates from a magnitude 7 earthquake in the Salt Lake City area. *Scenario for a Magnitude 7.0 Earthquake on the Wasatch Fault—Salt Lake City Segment—Hazards and Loss Estimates* is available at dem.utah.gov/wp-content/uploads/sites/18/2015/03/RS1058_EERI_SLC_EQ_Scenario.pdf.

Also, EERI Utah is conducting a Utah Earthquake Resiliency Workshop (utah.eeri.org/?p=441) on April 27 at the Viridian Event Center in West Jordan. This workshop will highlight topics related to improving community recovery after a damaging earthquake. The workshop will feature nationally known experts as keynote speakers with significant background in the field of resilience.

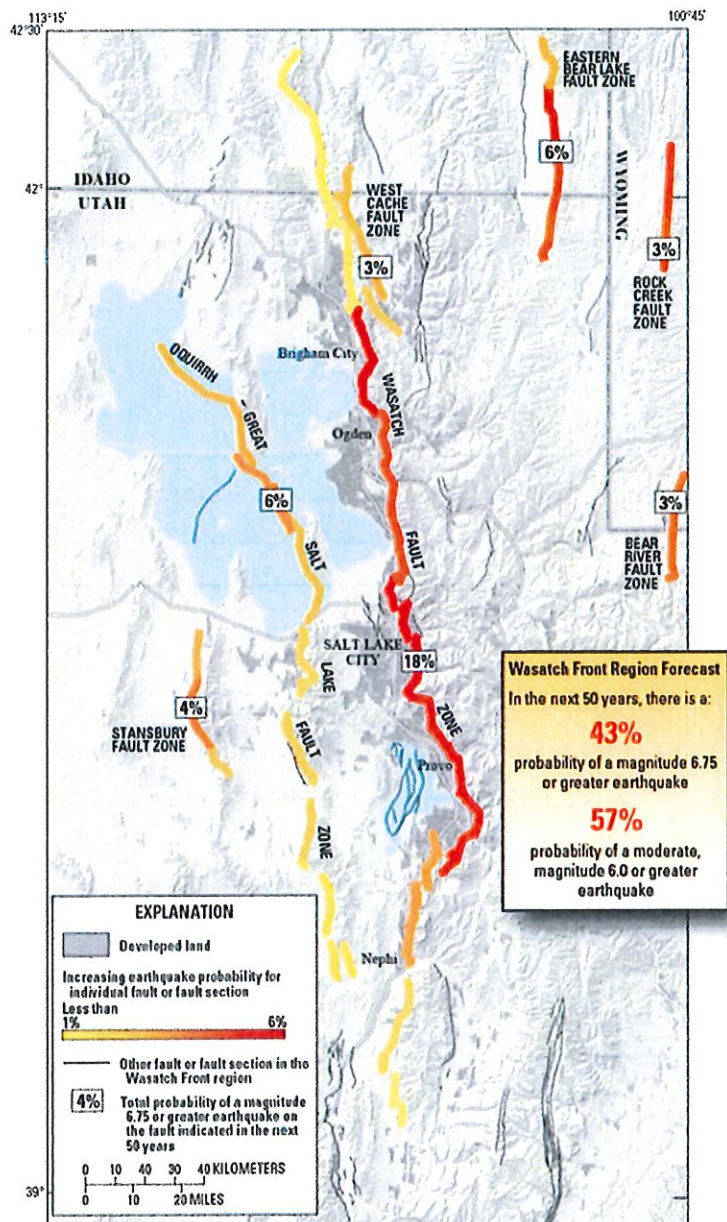
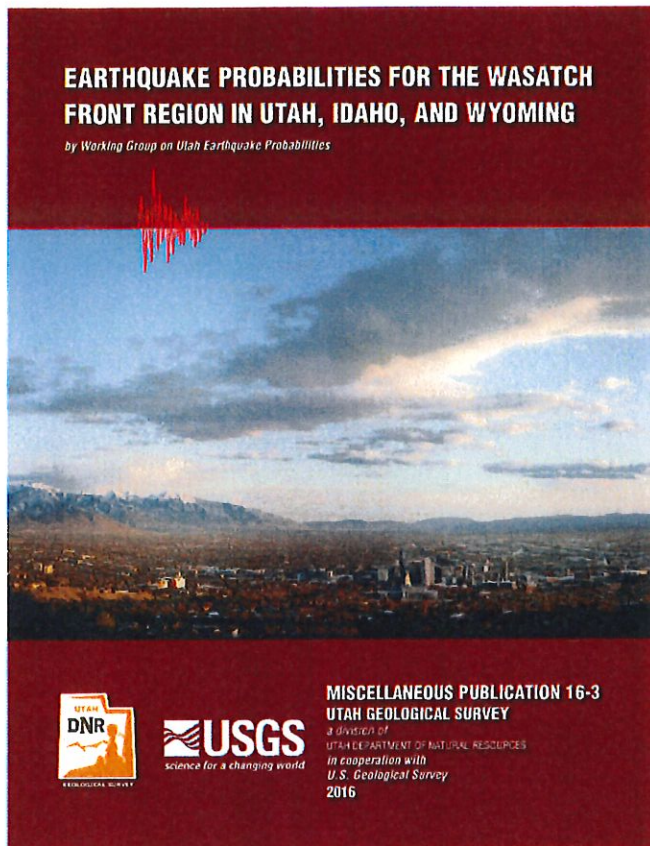
Utah Geological Survey Miscellaneous Publication 16-3, *Earthquake Probabilities for the Wasatch Front Region in Utah, Idaho, and Wyoming*, is expected to be released in early May and will be available for purchase from the Utah Department of Natural Resources Map and Bookstore, 1-888-UTAHMAP, www.mapstore.utah.gov. A PDF will be viewable on the UGS website at geology.utah.gov. This research was funded by grants from the USGS National Earthquake Hazards Reduction Program with additional support from the Utah Geological Survey and URS Corporation. The Utah Geological Survey, a division of the Utah Department of Natural Resources, provides timely scientific information about Utah's geologic environment, resources, and hazards.

The U.S. Geological Survey has produced a non-technical summary of the full earthquake probabilities report. USGS Fact Sheet 2016-3019 is available at pubs.er.usgs.gov/publication/fs20163019.

For more information about the Wasatch Front earthquake forecast, please contact:

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(925) 482-0360
wong@lettisci.com





Map from USGS Fact Sheet 2016-3019

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EARTHQUAKE PROBABILITIES FOR THE WASATCH FRONT REGION IN UTAH, IDAHO, AND WYOMING

by Working Group on Utah Earthquake Probabilities

EXECUTIVE SUMMARY

In a letter to *The Salt Lake Daily Tribune* in September 1883, U.S. Geological Survey (USGS) geologist G.K. Gilbert warned local residents about the implications of observable fault scarps along the western base of the Wasatch Range. The scarps were evidence that large surface-rupturing earthquakes had occurred in the past and more would likely occur in the future. The main actor in this drama is the 350-km-long Wasatch fault zone (WFZ), which extends from central Utah to southernmost Idaho. The modern Wasatch Front urban corridor, which follows the valleys on the WFZ's hanging wall between Brigham City and Nephi, is home to nearly 80% of Utah's population of 3 million. Adding to this circumstance of "lots of eggs in one basket," more than 75% of Utah's economy is concentrated along the Wasatch Front in Utah's four largest counties, literally astride the five central and most active segments of the WFZ.

Since the late 1960s, abundant paleoseismic data on the timing and size of prehistoric surface-rupturing earthquakes have been collected on the WFZ and other faults in Utah's Wasatch Front region, which extends into southeastern Idaho and southwestern Wyoming (Figure ES-1). Motivated, in part, by the recent development of improved methods to analyze paleoseismic data, a Working Group on Utah Earthquake Probabilities (WGUEP) was formed in January 2010, under the auspices of the Utah Geological Survey (UGS) and the USGS, to evaluate the probabilities of future occurrence of moderate-to-large earthquakes in the Wasatch Front region. The working group consisted of 14 geologists, seismologists, and engineers affiliated with diverse Federal, State, academic, and consulting organizations.

The WGUEP's goal was to develop probabilistic earthquake forecasts for the Wasatch Front region that include: (1) combined time-dependent and time-independent probabilities of large earthquakes for the five central segments of the WFZ and two segments of the Great Salt Lake fault zone, (2) time-independent probabilities for less well-studied faults, and (3) estimates of the time-independent probabilities of background earthquakes not associated with known or mapped faults in the moment magnitude (M) 5.0 to 6.75 range.

The WGUEP provides these forecasts with the hope that they will help heighten the public's awareness and understanding of the region's seismic hazards, just as the forecasts of the Working Groups on California Earthquake Probabilities (WGCEP) have successfully done. Our consensus-based time-

dependent and time-independent earthquake probabilities in the Wasatch Front region are not only useful for regional hazard analyses, they also provide a robust basis for site-specific probabilistic seismic hazard analyses (PSHAs) for the safe design and evaluation of critical structures and facilities. Further, our time-dependent probabilities for fault ruptures can be incorporated into the PSHAs that will underpin urban seismic hazard maps planned by the USGS for the Wasatch Front region. Additionally, our earthquake forecasts can aid in developing public policies leading to more effective, sustained earthquake mitigation efforts in the Wasatch Front region.

Similar to the approach used by the 2008 WGCEP, the WGUEP methodology relies on four basic model components: a seismic source model, a deformation model, an earthquake rate model, and a probability model. In general, the seismic source model characterizes the physical geometry of the known faults; the deformation model gives recurrence intervals and/or slip rates for each fault segment and/or fault; the earthquake rate model gives the long-term rate of all earthquakes throughout the region above a specified threshold (in this case M 5.0 and greater); and the probability model gives a probability for earthquakes of different size over a specified time period. However, some significant differences exist between the WGUEP and the 2008 WGCEP model components; the WGUEP counterparts are much simpler due in large part to the availability of robust paleoseismic data for the WFZ and other faults in the Wasatch Front region.

Our probability model describes how earthquakes are distributed in time. The simplest version is the time-independent Poisson (memoryless) model, which assumes that each earthquake is completely independent of the timing of all other events. For example, with this model it makes no difference in the forecast for the Salt Lake City segment whether its last rupture occurred yesterday or 1,000 years ago. Following the lead of the 2008 WGCEP, we have used only one time-dependent model, the Brownian Passage Time (BPT) model. The BPT model is a stress-renewal model that computes the probability of each segment rupturing conditioned on the length of time since the last event.

The WGUEP seismic source model consists of six groups of seismic sources: (1) the five central segments of the WFZ, (2) the end segments of the WFZ, (3) the combined Oquirrh-Great Salt Lake fault zone (OGSLFZ), (4) antithetic fault pairs (two faults that intersect each other at depth and may rupture coseismically), (5) significant other faults

in the Wasatch Front region, and (6) crustal background earthquakes. Background earthquakes are defined as those events less than $M 6.75 \pm 0.25$ that cannot be associated with a known fault. A classic example of a background earthquake within the Wasatch Front region is the 1975 $M 6.0$ Pocatello Valley, Idaho, earthquake.

The 350-km-long WFZ consists of 10 segments that are thought to have ruptured repeatedly and independently in large magnitude ($M \geq 6.75$) earthquakes. The five central segments from north to south are the Brigham City, Weber, Salt Lake City, Provo, and Nephi segments (Figure ES-1). These central segments are thought to be the most hazardous, because each segment has had multiple large Holocene (past 11,700 yrs) earthquakes that have produced surface rupture. Detailed geologic investigations at 23 paleoseismic sites on these segments have yielded data on the timing of past earthquakes and/or measured single-event fault displacements. The resulting data show that at least four to five earthquakes large enough to cause surface rupture have occurred on each central segment in the past ~6000 years. Despite the abundant paleoseismic data, a number of important questions needed to be considered in the WGUEP forecast. For example, although the paleoseismic data generally support the prevailing segmentation model for the WFZ, is it possible that adjacent segments have ruptured together, in whole or part, during a single large earthquake? To address the questions and reduce uncertainties in the sizes and timing of past events, we extensively and systematically reviewed and analyzed all of the available paleoseismic data for the five central segments.

At least 22 surface-faulting earthquakes have ruptured the central segments of the WFZ since about 6000 years ago, based on our analysis of all of the paleoseismic data and assuming that each earthquake ruptured a single segment of the fault zone. Using our revised surface-faulting earthquake histories for each segment, we calculated inter-event and mean recurrence intervals, which indicate a moderately periodic pattern of earthquake recurrence on the central WFZ as a whole: inter-event times for the segments range from 700 to 2700 years, and mean recurrence intervals range from 900 to 1500 years, similar to a composite mean recurrence interval for the central WFZ of about 1200 years.

Although we favor single-segment ruptures as the dominant earthquake process on the WFZ, we addressed uncertainties in the model by constructing rupture models that include both single- and multi-segment ruptures and by defining spatial uncertainties in the segment-boundary locations. We developed the models following our evaluation of possible multi-segment ruptures, which relied mostly on per-segment earthquake timing and displacement data. A companion *unsegmented* model allows potential "floating" ruptures along the WFZ that ignore the location of segment boundaries, thus complementing the range of possible ruptures included in the segmented models. The single-segment rupture model

received more weight than those including multi-segment ruptures based on the significant timing differences in the youngest and best-constrained earthquakes along the fault, unique surface-faulting histories per segment, displacement-per-event data, and the presence of prominent bends or stepovers in the fault trace and/or basin depth changes at the segment boundaries. Characteristic magnitudes for the central WFZ segments range from a best-estimate $M 7.1$ for the Brigham City segment to $M 7.3$ for the Provo segment.

In addition to examining the central WFZ segments, we reviewed and evaluated paleoseismic data for other faults in the region to develop rupture models, characteristic earthquake, and rate information (earthquake timing and/or fault slip rates) for input into the WGUEP forecasts. These other faults included: (1) the end segments of the WFZ; (2) the OGSFZ, particularly the Antelope Island and Fremont Island segments of the Great Salt Lake fault; (3) antithetic fault pairs such as the West Valley fault zone and the Salt Lake City segment of the WFZ; and (4) 45 other faults in the Wasatch Front region.

Paleoseismic data for the five central segments of the WFZ as well as the Antelope Island and Fremont Island segments of the Great Salt Lake fault zone are sufficiently robust that we analyzed them in both a time-dependent and time-independent manner. The WFZ end segments, the Oquirrh fault zone, and all other faults were treated solely in the traditional time-independent manner due to insufficient information for a time-dependent analysis.

The background earthquake model depicts the fraction of future mainshocks in the Wasatch Front region that are expected to occur on seismic sources other than faults identified in the WGUEP fault model. For purposes of the WGUEP forecast, the background earthquake model provides rates for future mainshocks of $M 5.0$ or greater up to a maximum of $M 6.75 \pm 0.25$. The probabilities for background earthquakes were treated only in a time-independent manner.

We compiled and processed an up-to-date historical and instrumental earthquake catalog for the background earthquake model that meets the needs of state-of-practice seismic hazard analysis, namely a catalog that: (1) is complete in terms of accounting for all known earthquakes in the magnitude range of interest; (2) assigns a uniform moment magnitude to each event; (3) identifies "dependent" events (foreshocks, aftershocks, and the smaller events of earthquake swarms) in earthquake clusters that can be removed for statistical analysis of mainshock recurrence parameters; (4) excludes non-tectonic seismic events such as blasts and mining-induced seismicity; and (5) quantifies the uncertainty and rounding error associated with the assigned magnitude of each earthquake.

Geodetic data were used in the most recent WGCEP forecasts and are increasingly being used in probabilistic seismic hazard analyses to estimate fault slip rates. Because of

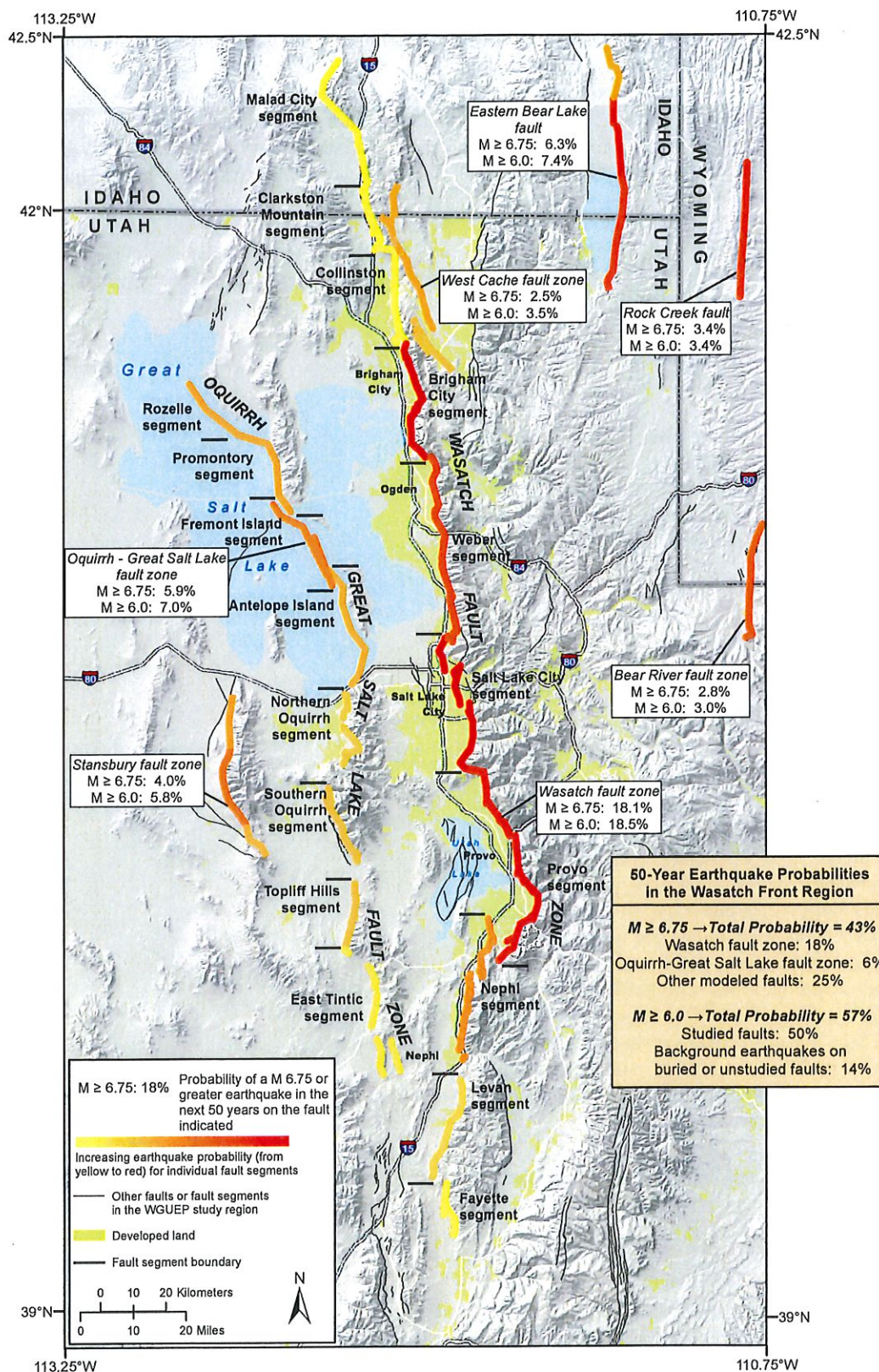


Figure ES-1. Probabilities of one or more earthquakes of $M 6.0$ and 6.75 or greater in the next 50 years (2014–2063) in the Wasatch Front region. “Other modeled faults” are those faults other than the Wasatch and the Oquirrh–Great Salt Lake fault zones. “Studied faults” include the Wasatch and Oquirrh–Great Salt Lake fault zones and the other modeled faults. Shaded topography generated from 90-m digital elevation data (<https://eros.usgs.gov/elevation-products>).

discrepancies observed in previous studies between geodetic moment rates and geological/seismological moment rates in the Wasatch Front region, we compared these rates for both the Wasatch Front region as a whole and four subregions. The geodetic moment rates for the Wasatch Front region, and for three of its four subregions, are consistent with the geological/seismological moment rates calculated for the WGUEP earthquake rate model. The geodetic moment rates are not consistent with the WGUEP earthquake rate model in the fourth subregion, an area that encompasses the Levan and Fayette segments of the WFZ. Further work is needed to identify the cause of this moment rate discrepancy; however, regardless of the cause of the discrepancy, we do not expect it to significantly affect the WGUEP forecast for the Wasatch Front region as a whole.

Based on the inputs summarized above, Figures ES-1 and ES-2 summarize earthquake probabilities in the Wasatch Front region in the next 50 years. The probability of one or more large ($M \geq 6.75$) earthquakes occurring in the Wasatch Front region in the time period of 2014 to 2063 is 43%. This regional probability is for earthquakes on all of the characterized faults and the background seismicity. The probability of one or more earthquakes of M 6.0 or larger in the Wasatch Front region in the next 50 years is 57% (Figure ES-1). In addition to the probabilities shown on Figures ES-1 and ES-2, the probability of one or more earthquakes of M 5.0 or larger in the Wasatch Front region in the next 50 years is 93%.

A significant contribution to these total probabilities comes from the WFZ and OGSLFZ. The total probability of at least one earthquake of M 6.75 or larger on either of these two fault zones is 23% in the next 50 years. The total probability from the other modeled faults is 25% due in part to some significant contributions from faults with higher slip rates such as the Eastern Bear Lake and Stansbury fault zones (Figure ES-1). The Eastern Bear Lake fault has a probability of 6.3% for one or more earthquakes of M 6.75 or larger in the next 50 years (Figure ES-1). For one or more earthquakes of M 6.0 or larger on the other faults, the 50-year probability is 34%. For background earthquakes of M 6.0 or larger on buried or unknown faults, the 50-year probability is 14%.

Figure ES-2 shows the 50-year probabilities for earthquakes of M 6.75 or larger on selected fault segments. For example, the probabilities on the Salt Lake City, Brigham City, Provo, and Weber segments are 5.8%, 5.6%, 3.9%, and 3.2%, respectively. The 50-year probability on the Nephi segment is relatively low at only 1.8% because its most recent rupture occurred only about 300 years ago. Although these individual probabilities might seem small, the total probability for an earthquake of M 6.75 or larger somewhere on the WFZ in the next 50 years is 18%. In the next 100 years, the probability increases to 33%. Such a large earthquake occurring anywhere along the WFZ will result in significant damage to communities in the Wasatch

Front region and to the economy of the region as a whole (e.g., see Earthquake Engineering Research Institute, 2015).

Considering that the average age of Utah's citizens is the youngest in the nation with a median age of 29.2 years, there is a realistic chance that many current residents of the Wasatch Front region will experience a large earthquake in their lifetimes. Preparing for earthquakes requires an awareness that even earthquakes in the M 5 range can cause significant localized damage in urbanized areas, and the probability of earthquakes of this size occurring in the coming decades is very high.

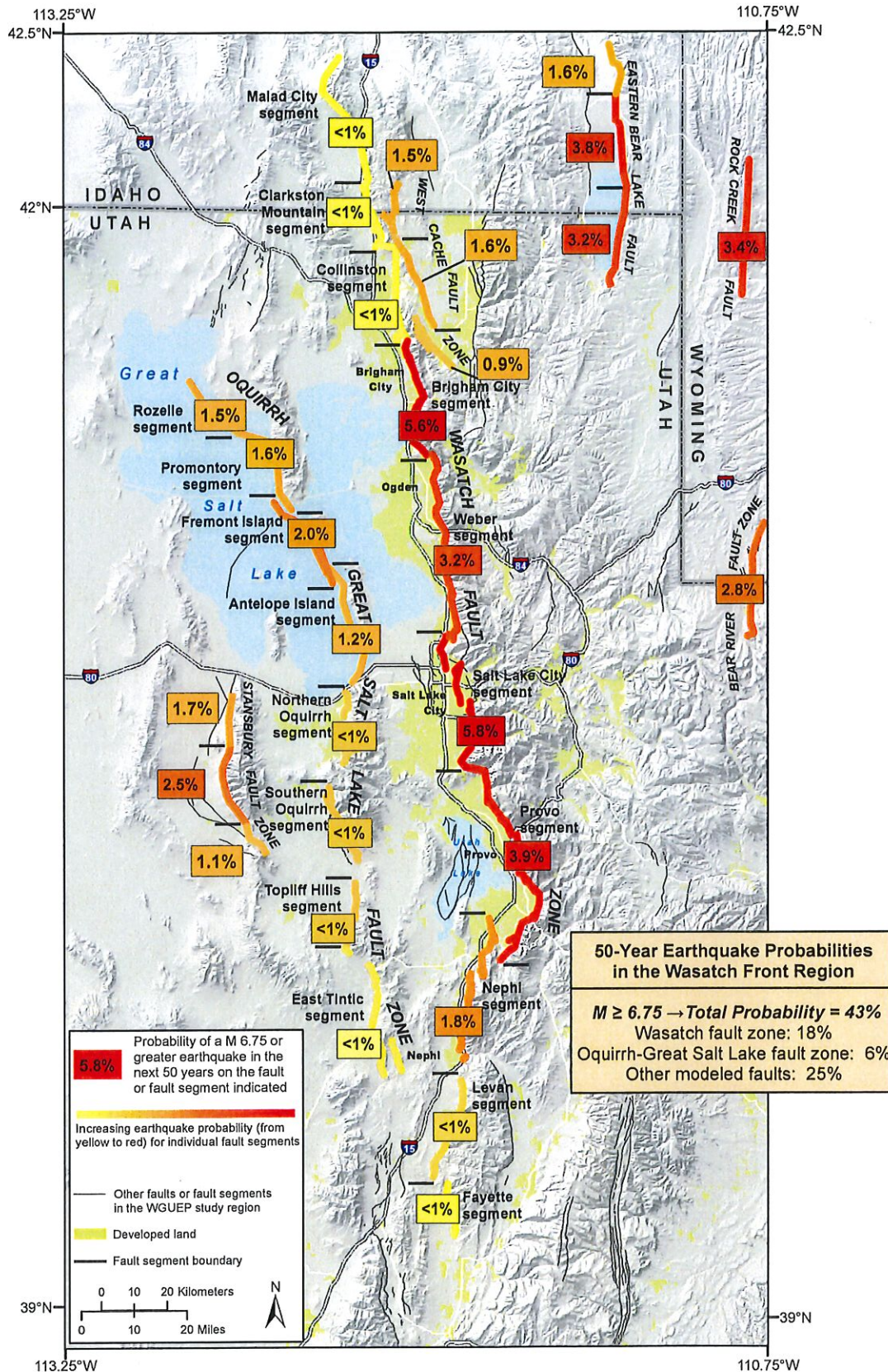


Figure ES-2. Probability of one or more earthquakes of $M \geq 6.75$ and greater in the next 50 years on selected fault segments. Shaded topography generated from 90-m digital elevation data (<https://eros.usgs.gov/elevation-products>).



ITEM 2

Utah Resiliency Workshop

UTAH EARTHQUAKE RESILIENCY WORKSHOP

April 27, 2016 | Viridian Event Center at West Jordan Library



Wednesday, April 27th
8:00 a.m. - 5:00 p.m.
Registration at 7:30 a.m.

Viridian Event Center
at the West Jordan Library
8030 S. 1825 W.
West Jordan, UT

Ticket prices:
Early Registration:
General \$55
Student \$25

After April 13th:
General \$70
Student \$40



GUEST SPEAKERS

Chris D. Poland, SE, NAE
Consulting Engineer
Earthquake and Disaster Resilience

Kent Yu, PhD, SE
SEFT Consulting Group
Learning from the Oregon Recovery Plan

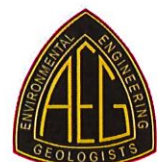
Judith Mitrani-Reiser, PhD
Johns Hopkins University

Register @ <http://utah.eeri.org>

PANEL DISCUSSION 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?
- **Utilities and Infrastructure:**
Understanding the Interdependencies
- **The Role of Government:**
Mitigation Efforts & Recovery Expectations

SPONSORS



Partial funding for this educational opportunity is generously provided by the Division of Occupational and Professional

SCHEDULE

7:30 - 8:00 am	Registration & Check-in	
8:00 - 8:15	Introductions	
8:15 - 9:00	Keynote Speaker: Chris Poland, SE, NAE	Tab 1
9:00 - 9:45	Earthquakes: Public Perception vs Reality	Tab 2
9:45 - 10:00	Break	
10:00 - 10:50	The Critical Three: Schools, Housing & Jobs	Tab 3
10:55 - 11:45	Utah's Economic Resilience: Getting the Wheels Rolling Again	Tab 4
11:45 - 12:30	Lunch	
12:30 - 1:15	State Healthcare Resiliency Efforts: What Can We Learn?	Tab 5
1:20 - 2:05	Public Works and Lifelines: Understanding the Interdependencies	Tab 6
2:10 - 3:00	Role of Government: Mitigation Efforts & Recovery Expectations	Tab 7
3:00 - 3:15	Break	
3:15 - 4:00	Closing Keynote: Kent Yu, SE Learning from the Oregon Resiliency Plan	Tab 8
4:00 - 5:00	Discussion & Planning	Tab 9

TAB #1

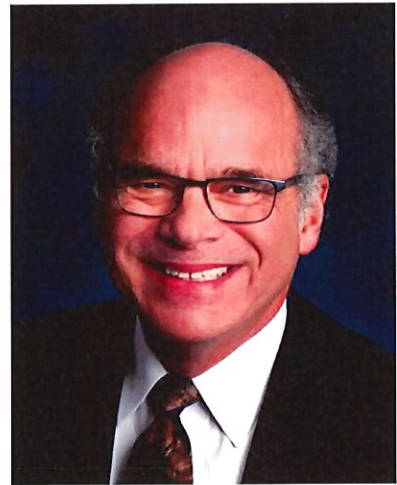
Keynote Speaker

CHRIS POLAND, SE, NAE

A world renowned authority on earthquake engineering and champion of disaster resilience, Chris Poland's passion for vibrant, sustainable and healthy communities drives his current consulting practice. He focuses on community resilience and the buildings and systems that contribute to it.

Chris served on the Board of Directors for SPUR, co-chaired their Resilient City Initiative and led the publication of "The Disaster Resilient City". He was the founding co-chair of the San Francisco Lifelines Council with Mayor Edwin Lee and served from 2009 through 2014. Chris was recently appointed to the Executive Committee of the new ASCE Infrastructure Resilience Division. He is a Disaster Resilience Fellow in the National Institute of Standards and Technology and member of the team of authors that developed their Community Resilience Planning Guide and is currently involved in numerous follow-on projects. Chris was inducted into the National Academy of Engineering in 2009.

His structural and earthquake engineering career spans over 42 years and includes hundreds of projects related to the design of new buildings, seismic analysis and strengthening of existing buildings, as well as the development of guidelines and standards that are used worldwide. He was a Senior Principal, Chairman and CEO of Degenkolb Engineers during his 40 years with the firm from 1974 through 2014.



TAB #2

Earthquakes: Public Perception vs. Reality

PANELISTS

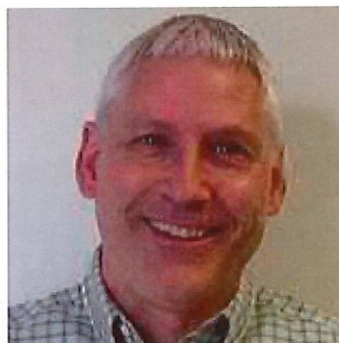
Dr. James C. Pechmann
Dr. Steven F. Bartlett, PE
Brent Maxfield, SE

MODERATOR

Dr. Jerod Johnson, SE

The panel of engineers and seismologists will share perceptions the public has in regard to how engineers use the building code to design buildings and the performance expectations of code-designed buildings following an earthquake.

They will also cover the ground motions the code requires to be used for building design and how these ground motions relate to what could happen in a magnitude 7 earthquake.



EARTHQUAKES: PUBLIC PERCEPTION VS. REALITY

DR. JAMES C. PECHMAN

*Seismologist, Department
of Geology & Geophysics
University of Utah*

Dr. Pechmann is a seismologist in the Department of Geology and Geophysics at the University of Utah, where he is currently a Research Associate Professor. He earned a B.A. degree in Geology in 1976 from Hamilton College and a Ph.D. in Geophysics in 1983 from the California Institute of Technology.

In his 33 years at the University of Utah he has done research on earthquake hazards, seismotectonics, earthquake source properties and ground motions and crustal structure in the eastern Basin and Range Province.

Dr. Pechmann has also provided technical and scientific support for the University of Utah seismic network's ongoing operation, development, and data analyses, supervised graduate student research, and done some teaching and consulting work. He has served on many committees and working groups related to earthquake hazards, including the Working Group on Utah Earthquake Probabilities which recently released the results of its six-year-long project.

DR. STEVEN F. BARTLETT, PE

*Department of Civil &
Environmental Engineering
University of Utah*

Dr. Bartlett has a bachelor of science in geology (1983) and a doctorate in civil engineering (1992) with an emphasis in geotechnical engineering from Brigham Young University.

He is a licensed professional engineer in the State of Utah and has 25 years of design and construction experience working with Westinghouse, Woodward-Clyde Consultants, Utah Department of Transportation Research Division and the University of Utah. Currently, he is an associate professor of Civil and Environmental Engineering at the University of Utah.

His research interests are in the development, design and long-term performance monitoring of construction technologies for transportation systems and infrastructure with an emphasis on rapid construction techniques, improving seismic resiliency and risk and vulnerability assessments.

EARTHQUAKES: PUBLIC PERCEPTION VS. REALITY

BRENT MAXFIELD, SE

*Civil/Structural Engineer,
Special Projects Department
The Church of Jesus Christ
of Latter-day Saints*

Brent is a Professional Structural Engineer with over 30 year experience working on structural and seismic projects. He is currently employed by The Church of Jesus Christ of Latter-day Saints.

Brent is an active member of local professional societies. He has served two terms on the Board of the Structural Engineers Association of Utah (SEAU) and is currently the Past President of the Earthquake Engineering Research Institute (EERI) Utah Chapter. He is the author of three books on the use of the software program Mathcad.

Brent has been instrumental in getting the Building Occupancy Resumption Program (BORP) adopted in Salt Lake City, Murray City and Farmington.

In 2012, he was named the Utah Engineer of the Year by the Utah Engineers Council.

DR. JEROD JOHNSON, SE

*Principal Structural Engineer
Reaveley Engineers +
Associates*

Jerod is a principal with Reaveley Engineers + Associates and has over 22 years of design and construction experience. He received his degrees at the University of Utah and is currently an adjunct professor teaching courses in concrete, masonry and timber design and also serves as a guest lecturer and member of multiple graduate student committees.

Dr. Johnson's continuing research is focused toward structural dynamics and earthquake engineering where he has been principal investigator for analytical studies of the effectiveness of nonlinear tuned mass dampers for improving building resilience. He has also undertaken major research projects investigating the effect of aging and stability on base isolation system performance.

He has played a key role in some of the most significant projects of the region including the Salt Palace Expansion, South Towne Exposition Center and the Utah State Capitol Renovation and Base Isolation. He is a regularly featured author for SEAU monthly newsletter and Structure magazine, the official monthly publication of the National Council of Structural Engineers Associations.

He currently serves on the board of directors as past president of SEAU and has served as a member of the board for the Utah Chapter of the Earthquake Engineering Research Institute.

TAB #3

The Critical 3: Schools, Housing & Jobs

PANELISTS

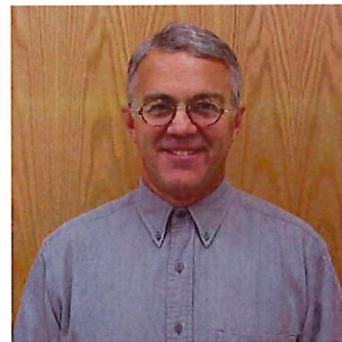
Sheila Curtis
Jenefer Youngfield
Ralph Ley
Dr. Jerod Johnson, SE

MODERATOR

Barry Welliver, SE

How will buildings perform following earthquakes? The intent of building codes is to protect lives, but does it adequately address the building damage that could occur to a code-designed building?

These questions lead to a discussion of whether specific buildings should be designed to a higher standard than required by building code to help better protect schools, housing and businesses. Damaged, unoccupied buildings could adversely affect recovery efforts.



THE CRITICAL 3: SCHOOLS, HOUSING & JOBS

SHEILA CURTIS

*DEM Operations Planner
Dept. of Public Safety,
Division of Emergency Mgmt.*

Sheila is the Operations Officer for the Utah Division of Emergency Management and has been there for over five years. She has been in Emergency Management for over 20 years starting at the city level of emergency management.

She is also over the Utah Housing Task Force. Sheila has been deployed through EMAC twice to the state of New York.

She has been very active in various communities with neighborhood watch, Youth City Council and the Lions Club. She also helped start the first Millard County CERT Program.

Sheila served as a council member for the Town of Hinckley for over six years. She was the Eagle Mountain City Emergency Manager for six years at which time she started the CERT program, helped start the Youth City Council and helped with the Neighborhood Watch program.

She loves to go rock hunting in the deserts of our lovely Utah and enjoys camping with her family of four girls and seven grandkids.

JENEFER YOUNGFIELD

*Construction & Facility
Specialist, Utah State Office
of Higher Education*

Jenefer has 32 years of experience in the K-12 public school construction and facility safety and security. She is responsible for the oversight, support, training and assurance of compliance of LEAs (Local Education Agencies – school districts and charter schools) and those involved in K-12 public school construction, facility safety and security procedures, including: federal, state and local codes, rules, laws, and guidelines; the School Construction Resource Manual; the USOE Emergency Preparedness Planning Guide for Public Schools; ADA (Americans with Disability Act) accessibility; Office of Civil Rights (OCR) facility related reviews, seismic; fire; energy; FEMA (Federal Emergency Management Act).

She is a Certified Public Manager and a member of the Utah State Parent Teacher Association Safety Committee. Jenefer is also a member of the State Emergency Response Team (SERT) including the following annexes:

- ESF 3: Public Works & Engineering
- ESF 6: Mass Care
- ESF 7: Logistics
- ESF 11: Agriculture & Natural Resources

A graduate of Weber State University in Science, Jenefer is chair of the Utah State Building Licensing Board is International Code Council certified and DOPL licensed. She is also certified by the Utah Seismic Safety Commission as a building safety assessment disaster service worker.

THE CRITICAL 3: SCHOOLS, HOUSING & JOBS

RALPH LEY

*Protective Security Advisor -
Utah District, U.S. Department
of Homeland Security*

Ralph has served as the Protective Security Advisor (PSA) for the Utah District since November 2006. He serves in an advising and reach-back capacity for the Commissioner, Utah Office of Public Safety. As a PSA, he facilitates and coordinates resilience and vulnerability assessments for public and private sector entities; acts as a physical and technical security advisor to Federal, State, and local law enforcement agencies; and facilitates federal training, tools and other resources.

Joining the Department of Homeland Security (DHS) in February 2004, Ralph worked as the Plans and Policies Branch Chief, held oversight of the Dams and Commercial Facilities Critical Infrastructure Sectors and oversight of the Office of Infrastructure Protection's overseas risk program initiatives with Canada and Great Britain. Ralph has also served as the Chief of the High Value Targets (HVT) Assessment Unit with seven teams conducting security assessments at U.S. critical infrastructure sites.

Prior to joining DHS, Ralph worked in the private sector as a Program Manager at a defense-based manufacturing company in Florida. He previously served 22 years in the U.S. Air Force Special Operations Command working with foreign and joint counter-terrorist teams, and with joint service teams performing security assessments.

BARRY H. WELLIVER, SE
*Principal Structural Engineer
BHW Engineers*

Barry has been involved in structural engineering since 1973. Moving from Connecticut to pursue an interest in earthquake engineering, he chose California as his classroom. There he worked for several prominent firms before establishing his own private practice in 1979. After 22 years in California, he moved with his family to Utah where he currently practices.

He has been actively involved in the Structural Engineers Associations of California and Utah serving on and chairing several committees. His interests in seismic engineering lead to involvement with the Utah Seismic Safety Commission (USSC) beginning in 1996 as an observer and later as delegate commissioner for the Structural Engineers Association of Utah (SEAU).

Barry has been an advocate for seismic improvements in older existing hazardous buildings and served as the chair of USSC from 2002-2006.

For five years he advocated for state-wide school hazard inventory at the Utah Legislature and his efforts resulted in legislation and funding to complete rapid visual screening of Utah schools.

He has co-authored numerous publications related to seismic advocacy including Putting Down Roots in Earthquake Country: Handbook for Earthquake Safety in Utah.

TAB #4

Utah's Economic Resilience: Getting the Wheels Rolling Again

PANELISTS

Lance Davenport

Matthew Lund

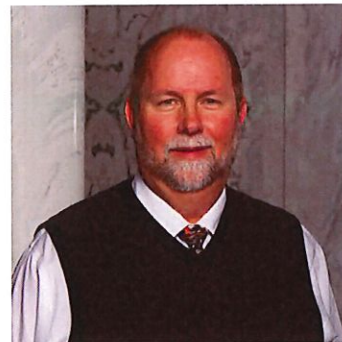
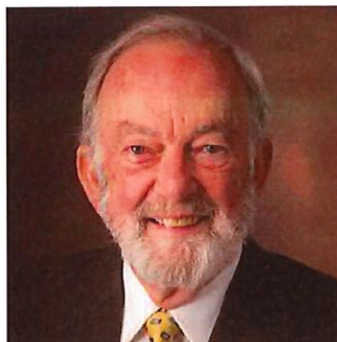
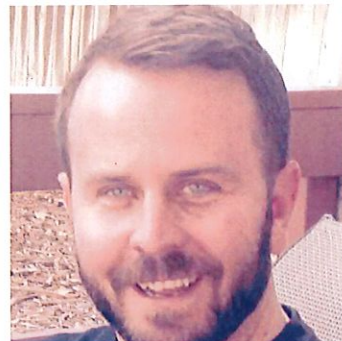
James A. Wood

MODERATOR

Bob Carey

Panelists will share ways to prevent an economic catastrophe following a magnitude 7 earthquake along the Wasatch fault.

In addition to discussing contemporary building codes -- including their strengths and weaknesses with respect to resilience and economic loss -- they will share their perspectives regarding the economics of recovery following a large earthquake.



UTAH'S ECONOMIC RESILIENCE: GETTING THE WHEELS ROLLING AGAIN

LANCE DAVENPORT

*Public Safety & Security
Larry H. Miller Sports and
Entertainment*

Lance joined the Larry H. Miller Group of Companies in 2013 as the director of safety and risk management where he had oversight for safety and risk management of each of the group's businesses and properties and assisted with emergency planning, preparedness and response. In August 2015, Lance moved to Larry H. Miller Sports and Entertainment where he now oversees public safety and security for LHMSE enterprises. He serves as the team security director for the Utah Jazz, and assists with the implementation, coordination and oversight of NBA security standards for the Vivint Smart Home Arena.

Prior to joining the group, Lance served as commissioner of the Utah Department of Public Safety, an appointment made by Utah Governor Jon Huntsman in January 2009. Previous to his appointment, he served as the superintendent of the Utah Highway Patrol. He began his law enforcement career as a UHP trooper in 1984 and held every rank in the department before being appointed the superintendent/colonel in 2006. He retired from public safety service in July 2013.

He earned an Associate of Science degree in law enforcement from Weber State University and graduated cum laude with a bachelor's degree in criminal justice. Lance is also a 2003 graduate of the FBI National Academy and a 2010 graduate of the FBI National Executive Institute. He completed the Leadership Certificate Program at the University of Utah in 1998.

MATTHEW LUND

*Budget & Policy Economist
Utah Governor's Office of
Management & Budget*

Matthew is a budget and policy economist with the Utah Governor's Office of Management and Budget.

His professional responsibilities include analyzing policy priorities related to transportation projects and physical infrastructure investments, reviewing and recommending budgetary changes for state agencies, forecasting economic indicator data and serving as a proxy voting member on the State Building Board and Internal Service Fund Rate Committees, among other duties.

Prior to serving in the Governor's office, Matt worked as a tax economist at the Utah State Tax Commission specializing in income taxes. He holds a PhD in Economics from the University of Utah.

UTAH'S ECONOMIC RESILIENCE: GETTING THE WHEELS ROLLING AGAIN

JAMES A. WOOD

*Ivory-Boyer Senior Fellow
Kem C. Gardner Policy Institute
University of Utah*

James is the Ivory-Boyer Senior Fellow at the Policy Institute. He specializes in several research areas including housing, construction, real estate, and economic development.

He has published over 100 articles and studies related to the Utah economy. This includes housing markets, community development, regional economics and economic development. He has conducted numerous studies on local housing market conditions, and was the principal investigator on a sustainable communities grant through the U.S. Department of Housing and Urban Development. He was also the principal investigator on a two-year cost-benefit study of homeless participants in Utah's Housing First Program.

A member of the Governor's Council of Economic Advisors, he also serves on the board of the Salt Lake Home Builders Association, the Salt Lake County Housing Trust Fund, Neighbor-Works Salt Lake and is a member of the State of Utah Revenue Assumptions Working Group.

A graduate of the University of Utah with a B.S. in finance and four years of graduate study in economics, Mr. Wood joined the business school in 1975 and spent over 25 years as a researcher and senior research analyst. He served as director of the Bureau of Economic and Business Research from 2002 to 2015.

BOB CAREY

*Operations Section Manager &
Operations Chief Earthquake Program
Manager, Division of Emergency
Management, State of Utah*

A graduate of Westminster College with Bachelor of Science degrees in both environmental studies and geology, Bob is the Operations Section Manager and Operations Chief, Utah Division of Emergency Management.

He has served for 22 years as the Earthquake Program Manager, Utah Division for Emergency Management, and in state service for over 25 years. He also serves as staff to the Utah Seismic Safety Commission.

Bob serves on the following committees/councils:

- Committee Member on the URM Ad-hoc Committee
- Committee Member on the Utah Committee for Urban Strong Motion Monitoring
- State Delegate to the Western States Seismic Council
- Committee Member on the Basin and Range Subcommittee

He served as a team member of the Multi-Agency Damage Evaluation Team for the 2009 Wells Earthquake and Utah Division of Comprehensive Emergency Management Response Team for the 1992 St. George Earthquake. He was team leader of Multi-Agency Evaluation Task Force for the 1994 Northridge Earthquake.

Bob is a member of the Structural Engineers Association of Utah's Existing Buildings Committee, Utah State Hazard Mitigation Team and board member of the Utah Chapter of the Earthquake Engineering Research Institute.

TAB #5

State Healthcare Resiliency Efforts: What Can We Learn?

PANELISTS

Dr. Judith Mitrani-Reiser
Michael W. Stever

MODERATOR

Bob Carey

Hospitals are designed to the IBC using a Seismic Importance Factor of 1.5, but what does this mean in terms of a hospital's ability to operate following a magnitude 7 earthquake?

Designing only to the code may not provide the operational elements necessary to service the public. Even with relatively robust code requirements, many seismic requirements beyond structural systems are often overlooked, which can lead to major adverse effects in an earthquake.

The Utah Department of Health has studied this issue and will present their findings and relate these to other government and nongovernment organizations.



STATE HEALTHCARE RESILIENCY EFFORTS: WHAT CAN WE LEARN?

DR. JUDITH MITRANI-REISER

*Assistant Professor of Civil
Engineering and
Emergency Medicine
Johns Hopkins University*

Dr. Mitrani-Reiser is an Assistant Professor of Civil Engineering and Emergency Medicine, and the Director of the Sensor Technology and Infrastructure Risk Mitigation (STIRM) Laboratory at Johns Hopkins University. Her research is focused on the performance assessment of critical infrastructure, the safety and economic impact of hazards on the built environment, the effective communication of these risks to the public, informed decision making for use in emergency management and policy making, and the interaction of humans with the built environment.

She also collaborates internationally with the Pontificia Universidad Católica de Chile, and the University of Canterbury in New Zealand.

Dr. Mitrani-Reiser is a member of the American Society of Civil Engineers (ASCE), the Earthquake Engineering Research Institute (EERI), the Seismological Society of America (SSA), and the World Association for Disaster and Emergency Medicine (WADEM).

She is the Secretary for ASCE's Subcommittee on Multi-Hazard Mitigation, and is a member of ASCE's Committee on Disaster Resilience of Structures and of the Committee of Critical Facilities in ASCE's Infrastructure Resilience Division, and a member of EERI's Learning From Earthquakes Committee.

She is currently the faculty advisor for the Society of Professional Hispanic Engineers and is the founder of the Postdoctoral Association at Johns Hopkins University.

MICHAEL W. STEVER

*Emergency Manager
Utah Department of Health,
EMS & Health Preparedness*

Mr. Stever is the Emergency Manager for Utah Department of Health, EMS/Preparedness Bureau. He oversees and assists in coordination of all aspects of Emergency Management in planning, preparedness, response and recovery.

Mr. Stever also serves as occasional adjunct instructor/facilitator for the Emergency Management Institute at the National Emergency Training Center in Emmitsburg, Maryland. He has served in leadership positions on the National Board of the Association of Contingency Planners, the Utah Chapter of the Association of Contingency Planners and the Utah Emergency Manager's Association.

Prior to working for the Utah Department of Health, Mr. Stever served as the Emergency Program Manager for Salt Lake City. Previously he served the State of Utah as State Training Officer, Exercise Training Officer, and most recently, Training Program Manager.

Mr. Stever's previous Emergency Management employment experiences include service as Deputy Director of Emergency Services and Director of Public Affairs at the county level.

Mr. Stever has a Bachelor of Science degree from Weber State University. Before pursuing advanced education, Mr. Stever proudly served in the United States Army Special Forces. Major Stever retired from active reserve military duty as a company commander for the 19th Special Forces Group of the Utah National Guard.

TAB #6

Public Works & Lifelines: Understanding the Interdependencies

PANELISTS

Jeff King

Peter W. McDonough, PE

Tim Peters

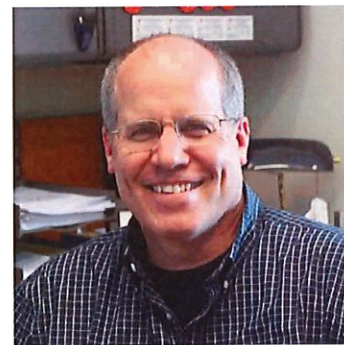
John Leonard, PE

MODERATOR

M. Leon Berrett, PE

Panelists will help attendees understand the fragility of various utility and infrastructure entities and the interdependency between them.

Through their discussion, the audience will gain a better understanding of the need to prepare to be without utilities for a period of time.



PUBLIC WORKS & LIFELINES: UNDERSTANDING THE INTERDEPENDENCIES

JEFF KING

*Security & Emergency
Response Coordinator,
Jordan Valley Water
Conservancy District*

As the Security and Emergency Response Coordinator, Jeff serves as a liaison with state and county emergency management, local emergency managers and county stakeholders. He is also responsible for training District personnel in security and emergency response procedures.

He administers the District's security systems and Jordan Valley Water Conservancy District Emergency Response Plan (EPR).

Jeff has a number of licenses and certifications including:

- Utah Grade IV Water Treatment and Grade IV Water Distribution
- ICS Train the Trainer #L449
- IS 700 ICS Overview
- IS 800 National Response Framework
- ICS 100, 200, 300, 400

His committee involvement includes the Private Sector Emergency Management Coordinating Council Steering Committee, Private Sector Preparedness Council, UT-WARN Steering Committee Member representing Large Wholesale Water Suppliers, Lifeline Infrastructure Resilience Council, Salt Lake Valley Homeland Security Grants Council, Salt Lake County Local Emergency Planning Committee and Envision Utah Committee Representing Drinking Water.

After 22 years, Jeff retired from the Utah Army National Guard, 142nd Military Intelligence Linguist Battalion.

PETER W. MCDONOUGH, PE

*Civil Engineer
Questar Gas*

Mr. McDonough has 45 years of engineering design, project management and supervisory experience, primarily relating to natural gas systems and critical infrastructure. He has a strong background in lifeline earthquake engineering and risk management, extending back to 1979.

He has written or contributed to 17 papers and books on the topic of lifeline earthquake engineering. He has presented papers at ten national and international conferences on earthquake engineering.

Peter holds a BS degree in Civil and Environmental Engineering from Clarkson College of Technology and a MS degree in Civil Engineering from the Polytechnic Institute of New York. He is a Licensed Professional Civil Engineer in Utah and Wyoming.

He is a past Executive Committee Chair of the American Society of Civil Engineers' Technical Council on Lifeline Earthquake Engineering (ASCE/TCLEE) and is current chair of ASCE's Infrastructure Resilience Division's Gas and Liquid Fuels Subcommittee.

Peter is a past (four term) chair of the Utah Seismic Safety Commission and currently represents ASCE on the Commission. He is a Fellow of the American Society of Civil Engineers and serves on the Board of Directors of The Western States Seismic Policy Council. Since 2012 he has been a member of the Utah Uniform Building Code Commission's Structural Advisory Committee. He was the 2013 President of the Utah Chapter of the Earthquake Engineering Research Institute.

PUBLIC WORKS & LIFELINES: UNDERSTANDING THE INTERDEPENDENCIES

TIM PETERS

*Public Services Manager
Public Works Department
City of West Jordan*

As West Jordan's Public Services Manager, Tim is responsible for the following divisions in the Department:

- Streets Maintenance – responsible for 855-lane miles of roadways, pothole repair, concrete repairs & maintenance and snow plowing
- Street Construction – responsible for the implementation of the City's pavement management program including crack-sealing, overlays in the City using the City's lay-down machine.
- Streets Operations – responsible for all graffiti removal in the City, solid waste collection for 23,000 customers through a waste hauler contract, 5,000 street lights, and proper street signage including street & traffic signs

Tim has approximately 29 years of public works related experience including working for the cities of Palo Alto, Belmont and Mountain View in California; Utah Department of Transportation; and, City of West Jordan.

He has had seven articles published in Public Works Magazine. Tim has also been active in APWA having served on the Emergency Preparedness Committee for the Utah Section and has made a number of presentations at multiple conferences. He is also been very active in the organization Engineers Without Borders" and traveled to Africa and the Navajo Nation in Arizona with the organization.

M. LEON BERRETT, PE

*Operations Associate Director
Salt Lake County Public Works
Operations Division*

Leon has been with Salt Lake County Public Works, Operations Division for over 13 years. One of his duties includes emergency management for Salt Lake County Public Works Operations. He has received extensive training in emergency management from attending training courses at the Emergency Management Institute in Emmitsburg, MD, to numerous training opportunities within Utah. He has also presented many presentations on the role of Public Works during a disaster.

Prior to Salt Lake County he served as the Riverton City Engineer for four years. His professional experience includes civil, structural and environmental engineering. Previous to Riverton City he had gained 14 years of professional engineering experience (seven years in private industry, seven in consulting). He has been project manager and/or engineer on a wide variety of projects with budgets ranging between thousands of dollars to over 20 million dollars.

His educational background includes BS and MS degrees in Civil Engineering from Brigham Young University. He is a Professional Engineer registered in Utah (active), Idaho (active), Nevada and Wyoming.

He currently is the Chair of the APWA (American Public Works Association) Utah Chapter Emergency Management Committee, Member of the APWA National Emergency Management Committee and Chair of the Utah Seismic Safety Commission. His second language is Spanish.

TAB #7

Role of Government: Mitigation Efforts & Recovery Expectations

PANELISTS

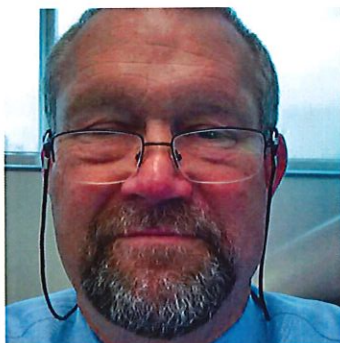
Kate Bowman
Dr. Divya Chandrasekhar
Cory Lyman
Lani Egertsen-Goff

MODERATOR

Brad Bartholomew

How do we bring older buildings up to current code performance levels?

And what are the benefits achieved for individual building owners and for the public? Panelists will explore how codes and standards can help speed up the rate of recovery.



ROLE OF GOVERNMENT: MITIGATION EFFORTS & RECOVERY EXPECTATIONS

KATE BOWMAN

*Solar Project Coordinator
Utah Clean Energy*

Kate is the Solar Project Coordinator for Utah Clean Energy, a non-profit, non-partisan organization in Salt Lake City whose mission is to lead and accelerate the clean energy transformation with vision and expertise.

She works to generate solutions that overcome barriers to solar market growth through successful partnerships with decision makers and leaders, including local governments, utilities and businesses.

Through the U.S. Department of Energy's Solar Market Pathways Initiative, Utah Clean Energy and Salt Lake City are partnering to explore the potential for solar energy combined with storage to increase community resiliency and emergency preparedness.

Kate's work on innovative programs designed to jump-start the clean energy economy create opportunities for businesses and builders who see the connection between clean energy and a sustainable future.

In April 2014, Kate Bowman was recognized by the White House as a "Champion of Change" for her efforts to promote and expand solar deployment.

Dr. DIVYA CHANDRASEKHAR

*Assistant Professor, Dept. of
City & Metropolitan Planning
University of Utah*

Divya is a faculty member in the City & Metropolitan Planning program within the College of Architecture + Planning and also affiliated with the department's Ecological Planning Center. Her research focuses on community and household recovery from catastrophic disasters, with an emphasis on disaster policy and planning practice.

Over the course of her career, Divya has examined recovery and reconstruction planning processes after disasters, community participation in recovery planning, the emergence of new institutions and coordination structures after disasters, post-disaster displacement, and household and business capacity to recover from major disasters. She specializes in case study research in domestic and international contexts, and in mixed method studies that combine survey and qualitative inquiry approaches.

Divya's research has been funded by the National Science Foundation, the Natural Hazards Center at Boulder, and the Mid-America Earthquake Center, and her work has been published in national and international journals.

She has also previously been a National PERISHIP Fellow with the Natural Hazards Center. Prior to joining the University of Utah, Divya was an Assistant Professor at Texas Southern University, Houston TX.

ROLE OF GOVERNMENT: MITIGATION EFFORTS & RECOVERY EXPECTATIONS

CORY LYMAN

*Director of Emergency
Management
Salt Lake City*

Cory has been the Director of Emergency Management for Salt Lake City since October 2008. He is responsible for design, development and implementation of the City's emergency operations plans and preparedness programs.

Current preparedness programs include Fix the Bricks (Un-Reinforced Masonry (URM) building seismic mitigation and Building Occupancy Resumption Program (BORP). He works with all city departments, government agencies, as well as private partners and volunteer groups to ensure the success of the city's goals. In his time as director, Cory has revitalized the department with his progressive vision and enthusiasm.

Cory brings a wealth of knowledge and experience to Salt Lake City. He served as Police Chief for Ketchum, Idaho, for five years. During which time there were several major events, including wild land fires and flooding that required significant evacuation of residents. Cory attributes part of the evacuation success to the use of media and volunteers.

Prior to that, Cory was a member of the Salt Lake City Police Department for 21 years functioning in many capacities including being part of the 2002 Olympics Communications Committee. During the Elizabeth Smart investigation Cory demonstrated his crisis leadership skills as commander of the task force. His extensive management experience in multiple areas and his ability to carry out missions successfully in times of crisis made him the ideal choice for his current position.

LANI EGERTSEN-GOFF

*Construction Program Manager
& Project Liaison, Engineering
Division of Salt Lake City*

Lani is a AICP planner working in the Engineering Division as a Construction Program Manager and Project Liaison. Her work encompasses civic engagement, public information, environmental permitting and project management.

She has also worked in the private sector while living in Utah -- in Transportation and NEPA consulting; in the public sector at the Kenai Peninsula Borough, City of Homer, and the State of Alaska Division of Parks and Outdoor Recreation while living in Alaska for over 13 years.

She attended Alaska Pacific University for her Master of Environmental Science degree, and Utah State University for a Liberal Arts degree.

Lani serves as the President of the Utah APA Chapter and enjoys interacting with many of the over 500 members of the chapter. She is the mother of a 12-year old son and has a busy husband who also works in the public sector. She enjoys walking her dog, Luna, and doing yoga as often as possible.

ROLE OF GOVERNMENT: MITIGATION EFFORTS & RECOVERY EXPECTATIONS

BRAD BARTHOLOMEW

*Mitigation & Recover Manager,
Div. of Emergency Management
State of Utah*

Brad is the Mitigation and Recovery Manager for the Division of Emergency Management. His work encompasses managing pre- and post-disaster mitigation projects, hazard mitigation plans through out the state and offering local assistance in responding to and recovery from disasters.

Brad has worked for the DEM for over 10 years after earning his Urban Planning degree from the University of Utah where he also received his Master in Public Policy.

He spends his free time with his young and busy family and working in his Rose Park community. He likes to take pictures of conference carpets.

TAB #8

Closing Speaker

DR. KENT YU, SE

Dr. Yu is Principal of SEFT Consulting Group located in Portland, Oregon. A licensed structural engineer and an earthquake/tsunami policy advocate, Dr. Yu conducted numerous post-earthquake reconnaissance to study performance of buildings and infrastructure systems.

Since 2011, he has led or contributed to seismic resilience planning projects at national, state and local levels.

As the Chair of Oregon Seismic Safety Policy Advisory Commission from 2011 to 2013, he led a team of 169 expert volunteers to develop the Oregon Resilience Plan to better prepare Oregon for next Cascadia earthquake and tsunami.

In 2015 Dr. Yu led a team to develop a resilience plan for the Beaverton School District, the third largest in Oregon. He also assisted National Institute of Standards and Technology (NIST) to develop Community Resilience Planning Guide for Buildings and Infrastructure Systems from 2014 to 2015.

Currently, he is involved in the development of Water System Resiliency Plan for Gresham, Oregon.



TAB #9

Discussion and Planning

PANELISTS

Many

MODERATORS

Matt Francis, PE

Chris Poland, PE

Dr. Kent Yu, PE

Dr. Judith Mitrani-Reiser

The final panel consisting of many of the days panelists in addition to leaders from various professional organizations and from government will do more than just discuss the material covered during the day.

The panelists for this discussion were chosen because of their position within their organizations to lead change and help drive the resiliency efforts within the State of Utah.

The moderators for this panel are experts in the field of resiliency and their experience will help guide the panel to set goals and form alliances which will form a foundation upon which communities in the State can build.



FINAL DISCUSSION AND PLANNING

Mathew Francis, PE
*Infrastructure Resilience
Manager*
AECOM

Mr. Francis manages the AECOM Southwest Area Water/Wastewater Department and Infrastructure Resilience Business Development, with 22 years' experience doing disaster risk reduction in over 20 nations focused on geotechnical design & construction of lifeline infrastructure and critical facilities, natural hazards risk assessments & climate adaptations. Expertise includes:

- Post-disaster investigations, geo-hazards characterization, Hazus loss modeling and exercises.
- Recovery planning guidance, policy development and building code performance evaluations
- Technology transfer of US hazards expertise and lifeline infrastructure resilience.
- Co-author of >30 publications including UN, USAID and FEMA funded recovery guidance for the Indian Ocean Tsunami, the Japan Tohoku Earthquake & Tsunami and Superstorm Sandy.

For USAID he is AECOM's program manager coordinating two global contracts Water Development IDIQ (WADI) and Making Cities Work (MCW). For FEMA he previously managed the \$37M Technical Assistance Research Contract (TARC), leading Hurricane Sandy mitigation assessment studies and several flood insurance reform studies for Congress. Mr. Francis also managed two transportation research programs in freight and urban planning for infrastructure supply chain risk, resumption of trade and sustainable return on investment (SROI). Mathew chairs the Critical Facilities subcommittee of the ASCE Infrastructure Resilience Division and is a member of ISSMGE Asian Technical Committee-1 developing climate resilience for geo-disasters. He has BS and MS Degrees in Civil Engineering from BYU.



ITEM 3

Distinguished Lecture

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**

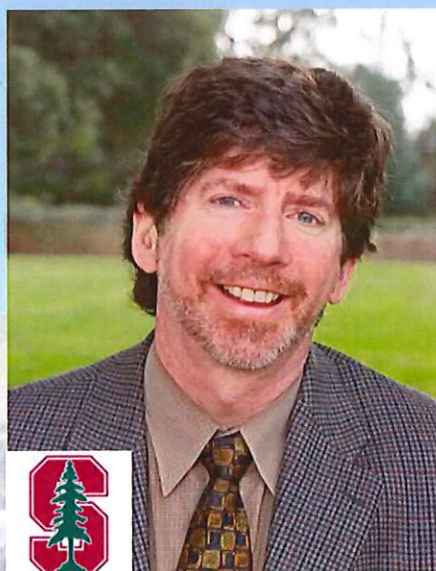
FROM PERFORMANCE-BASED ENGINEERING TO EARTHQUAKE RESILIENCE

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.



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



ITEM 4

Sample 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 champion 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 perseverance 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

National EERI

Structural Engineering Association of Utah (SEAU)

American Society of Civil Engineers (ASCE) – Utah

ASCE GEO-Institute

American Council of Engineering Companies (ACEC) - Utah

Seismological Society of America (SSA)

Southern California Earthquake Center (SCEC)

Utah Seismic Safety Commission (USSC)

Utah Geological Survey (UGS)

University of Utah Seismology and Active Tectonics Research Group

Utah Division of Occupational and Professional Licensure (DOPL)

United States Geological Society (USGS)

Be Ready Utah

Utah ShakeOut Website:

Homebuyer's Guide to Earthquake Hazards in Utah

<http://utah.eeri.org>

<http://www.eeri.org>

<http://www.seau.org>

<http://www.sections.asce.org/utah/>

<http://www.asce.org/geo/>

<http://www.acecutah.org>

<http://www.seismosoc.org>

<http://www.scec.org>

<http://ussc.utah.gov>

www.geology.utah.gov/utahgeo/hazards/index.htm

<http://www.uusatrg.utah.edu>

<http://www.dopl.utah.gov>

<http://earthquake.usgs.gov/>

<http://www.utah.gov/beready/>

<http://www.shakeout.org/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.