



We develop seismic policies and share information to promote programs intended to reduce earthquake related losses.



A non-profit earthquake consortium for the western states

**Winter 2016
e-Newsletter**
January 2016

**Western States
Seismic Policy Council**
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NATIONAL
EARTHQUAKE
CONFERENCE



**Call for Presentations
2016 National Earthquake Conference:**

What's New? What's Next? What's Your Role in the National Strategy?

The Conference will focus on the latest advances in earthquake science, best practices for outreach and education, building science and code advancement, and policy initiatives that improve resiliency.

If you are interested in contributing, please download the submission form (www.earthquakeconference.org/pdf/NEC_Presentation_Submission_Form.pdf) and submit a presentation proposal via email to barbara@flash.org no later than **Friday, January 15, 2016**.

Visit www.earthquakeconference.org for links to the agenda, registration and hotel information.

Thank You 2015 WSSPC Affiliate Members!

WSSPC welcomes all members of the professional community who share the common goal of reducing losses from earthquakes. Thanks to our 2015 Affiliate Members:

Corporate

- ◆ Degenkolb Engineers, Inc.
- ◆ Saunders Construction, Inc.
- ◆ State Farm Insurance Companies

Government

- ◆ City and County of San Francisco, Earthquake Safety Implementation Program
- ◆ City of Las Vegas, Department of Building and Safety
- ◆ Clark County, Nevada, Department of Building and Fire Prevention Bureau

Non-Profit Organization

- ◆ Applied Technology Council
- ◆ California Earthquake Authority
- ◆ Cascadia Hazards Institute, Central Washington University
- ◆ Earthquake Engineering Research Institute

Individual

- ◆ Dominic Sims

Join as an Affiliate Member for 2016 and get the following benefits:

- ⇒ Recognition of support with a link on the WSSPC website to your organization
- ⇒ Participation on WSSPC Committees providing input to policy recommendations
- ⇒ Quarterly E-Newsletters and Monthly Bulletins
- ⇒ Opportunities to exhibit and sponsor activities

Affiliate categories include corporate, government, university, non-profit and individual. For more information: www.wsspc.org/members/affiliate-members/

NEWS

ACEHR Releases Biennial Report on NEHRP

The Advisory Committee on Earthquake Hazards Reduction (ACEHR) Report to the Interagency Coordinating Committee (ICC) was submitted September 30, 2015. The report notes the progress that has been made by the National Earthquake Hazards Reduction Program (NEHRP) agencies in their core programs, but also makes 4 critical recommendations to revitalize earthquake risk reduction efforts in the U.S. In addition, key recommendations for the ICC, NEHRP office, and the NEHRP agencies were developed to enhance the effectiveness of NEHRP. To read the report: <http://nehrrp.gov/pdf/2015ACEHRRReportFinal.pdf>

Oregon Public Broadcasting "Unprepared" News Series Highlights Seismic Risk of Bridges

The Oregon Public Broadcasting's (OPB) weekly TV news magazine, Oregon Field Guide, asks the question "Will We Be Ready For The Megaquake In Oregon?" in its "Unprepared" series. The segments are grouped under the topics of *The Science*, *The Aftermath*, *Survival Mode*, and *Prepare Now*. A recent *The Aftermath* segment focused on the issue of critical bridges.

The OPB story references the Oregon Department of Transportation (ODOT) "Oregon Highways Seismic Plus Report" data. There are about 2800 bridges under state control (county or city bridges were not considered for this report), half of which were built prior to 1970, before seismic codes. Bridge design and construction did not take into account a magnitude 8+ Cascadia earthquake until the mid-1990s. Vulnerability evaluation of the bridges included age, type of construction and any previous retrofit history. Of the 1,232 bridges considered "lifeline" bridges, meaning they lie on critical routes that ensure mobility about the state after a disaster, 713 (58%) are seismically vulnerable or potentially seismically vulnerable.

The Report recommends action be taken for 718 bridges: 138 to be replaced, 390 retrofitted, and 190 to be rehabilitated and retrofitted, at an estimated total cost of over \$4 billion. The report recommends

a five phase approach over a period of several decades and also includes identification and mitigation recommendations for rock fall and landslide hazards related to these lifeline bridges.

Presently, according to OPB, the Oregon Legislature provides only enough funding to replace 1-3 bridges a year and there is no specific provision for funding for seismic retrofitting of bridges. The article compares this to the State of Washington which has already made significant progress retrofitting the more than 900 bridges of concern.

References:

www.opb.org/news/series/unprepared/

www.opb.org/news/series/unprepared/earthquake-oregon-bridges-collapse/

www.oregon.gov/ODOT/HWY/BRIDGE/docs/2014_Seismic_Plus_Report.pdf

www.wsdot.wa.gov/Bridge/Reporting/SeismicRetrofitProgram.htm

\$8.2 Million Approved by Congress for West Coast Earthquake Warning System

The omnibus spending bill passed by Congress in December, 2015, provides \$8.2 million to move earthquake early warning (EEW) towards full operability. Estimates are that an additional \$30 million would be needed to complete the system and approximately \$16 million a year for operations. The system is being developed by a research team including the USGS, California Institute of Technology, University of California at Berkeley, University of Washington and University of Oregon.

References:

losangeles.cbslocal.com/2015/12/19/congress-approves-8-2-million-for-west-coast-earthquake-early-warning-system/

www.latimes.com/politics/la-pol-ca-omnibus-spending-bill-california-20151218-htlstory.html

<http://mtnviewsnews.com/v09/htm/n51/p13.htm>

page 22, <http://docs.house.gov/meetings/RU/RU00/20151216/104298/HMTG-114-RU00-20151216-SD008.pdf>

2016: Year of the Clearinghouse: An Invitation to Participate

The earthquake clearinghouse concept was born in California, but is now adopted as a federal and national mandate, in recognition of the value clearinghouses contribute to response, recovery, and regional resilience. The California Clearinghouse's principal function is to be a forum for sharing information with the intent to provide Local, State and Federal disaster response managers, and the scientific and engineering communities, with prompt information on ground failure, structural damage, and other consequences from significant events such as earthquakes and tsunamis. Clearinghouse activations include participation from Federal, State and local government, law enforcement, fire, emergency management, public health, environmental protection, the military, public and non-governmental organizations, and the private sector.

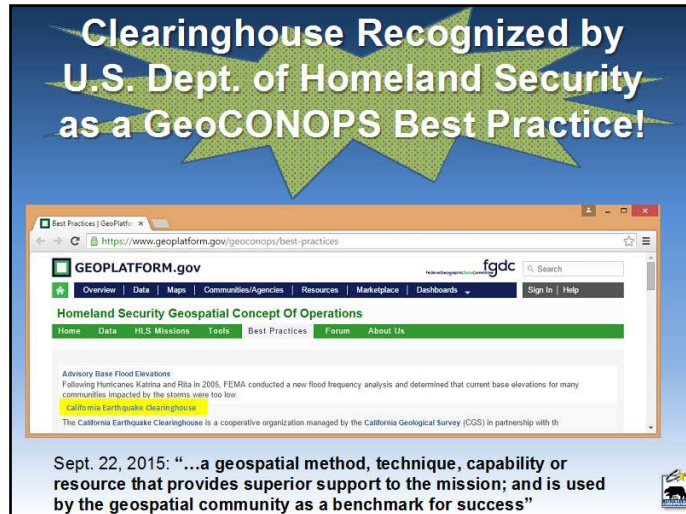
In California, Public Resources Code §2201 (c) requires establishing a post-earthquake information-sharing Clearinghouse. In addition, the National Earthquake Hazards Reduction Program (NEHRP) mandates establishing technical information clearinghouses within 24 hours following significant earthquakes (defined as resulting in a Presidential disaster declaration or designated by NEHRP agencies as providing an opportunity to learn how to reduce future earthquake losses) in the United States (USGS Circular 1242).

The Western States Seismic Policy Council (WSSPC) held a clearinghouse workshop and adopted the clearinghouse concept as a policy recommendation in 2001. The policy has been readopted every three years and will be subject to review and adoption in 2016. Washington state held a clearinghouse after the 2001 Nisqually earthquake, and Nevada-Utah after the 2008 Wells, Nevada earthquake. The Central United States Earthquake Consortium (CUSEC) has also adopted the clearinghouse concept.

The 2016 FEMA National Level Exercise, Cascadia Rising, is using an earthquake-themed scenario. Although Cascadia Rising will take place in FEMA Region X, in reality, the scenario will have a significant impact on California (FEMA Region IX), and thus the California Earthquake Clearinghouse is participating in the exercise. This provides a perfect opportunity for WSSPC member organizations to develop and test their clearinghouse plans, operations, and processes, and we invite our WSSPC partners to participate, both as individual organizations and as partners of the California Clearinghouse.

Our exercise goals are:

- Identify who our mutual clearinghouse counterparts are in other states/regions, and conduct a call-down to exchange updates of ongoing activities and availability of resources at clearinghouses in different regions.
- Learn more about how other states/regions accomplish the federal and national clearinghouse mandate. There is a lot to be gained from hearing other perspectives and sharing lessons learned.
- Continue to test and refine information sharing capabilities and technology interoperability; identify additional applications and partners for information sharing; understand Essential Elements of Information.
- Identify ways to coordinate more effectively to extend limited resources and reduce duplication of effort. The effects of a Cascadia Subduction earthquake will be felt throughout the Pacific Rim. The California Earthquake Clearinghouse recognizes that many of our partner organizations (USGS, NASA



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JPL, EERI) respond to earthquakes globally, in addition to earthquakes in California. Our partners will face the challenge of deploying limited resources to different states/regions/countries simultaneously. The California Earthquake Clearinghouse can assist them by providing data and helping to coordinate field activities/access.

Don't miss out on this rare opportunity for multi-state, multi-FEMA region clearinghouse coordination and collaboration.

Submitted by Anne Rosinski, Chair, California Earthquake Clearinghouse
Anne.Rosinski@conservation.ca.gov

For more information, visit:

www.californiaeqclearinghouse.org/exercises/2016-cascadia-rising-companion-exercise/

www.preptoolkit.org/web/cascadiarising2016

UNESCO Hosts First International Platform on Earthquake Early Warning Meeting

The United Nations Education, Scientific and Cultural Organization (UNESCO) held the initial meeting of the International Platform on Earthquake Early Warning Systems (IP-EEWS) December, 2015 in Paris. The IP-EEWS initiative was launched in October, 2015 to create an international community for cooperation, collaboration and data sharing to facilitate development of EEWS available to all countries prone to earthquakes. While several countries are currently developing or have already implemented EEWS, this is an effort to provide the potentially life-saving technology globally, including in developing countries that may lack the required resources to create their own. The project will increase community preparedness and resilience for earthquakes. The group is multi-disciplinary and includes public and private sector scientists, and policy makers.

UNESCO's Assistant Director-General, Flavia Schlegel noted that while 80% of natural disasters were climate-related, 70% of natural disaster deaths were from earthquakes. Chief of the Regional Programme and Disaster Risk Reduction Section at the UN Office for Disaster Risk Reduction (UNISDR), Neil McFarlane, listed access to good, reliable, timely information and the ability to provide it quickly to people as required components

for a successful system.

The initiative is part of the implementation of the Sendai Framework for Disaster Risk Reduction, a 15 year effort to reduce disaster risk and losses.

References:

www.unisdr.org/archive/46998

www.unesco.org/new/en/natural-sciences/about-us/single-view/news/launch_of_unescos_international_platform_on_earthquake_early_warning_systems/#.Vnm0gIng_gQ
www.unisdr.org/we/coordinate/sendai-framework

West Hollywood, California to Collect Building Inventory for Development of Seismic Retrofit Ordinance

The City of West Hollywood has contracted with Degenkolb Engineers to create a catalog of the estimated 6,000 buildings in the city. This is the first phase of a project that is expected to culminate with a retrofit ordinance tailored specifically to the city's building stock and vulnerabilities. Data collection by visual inspection began in December, 2015 and should be completed in February, 2016.

"Not all cities have the same inventory or construction type. Doing the inventory is an important piece of making sure our program is custom-designed for this city," said Cynthia Zabala, project manager for West Hollywood's Seismic Retrofit Program and Survey.

Details of the planned retrofit program, including mandatory or voluntary provisions and financing options, will be discussed based on the results of the building inventory.

References:

<http://www.weho.org/Home/Components/News/News/4378/23>

<http://www.latimes.com/local/lanow/la-me-ln-west-hollywood-earthquake-safety-20151210-story.html>

11% of University of British Columbia's Vancouver Campus Buildings at Risk of Collapse From Earthquake

Analysis in 2012 and 2013 of 49 buildings on the University of British Columbia's Vancouver campus by JM Engineering and Glotman-Simpson Consulting Engineers showed that most had some risk of collapse during a magnitude 6.5 earthquake; 28 rated as very high risk, 12 at high risk, and 7 with moderate risk. Buildings at risk include classrooms, offices, and the university's stadium. The campus, with approximately 400 buildings, could be subjected to a magnitude 8+ Cascadia megathrust earthquake off the coast. The report had not been released publicly until the student newspaper *Ubysey* requested it under a Freedom of Information request.

The University boasts a student population of more than 51,000 with 14,000 staff and faculty. It is likely that there would be casualties in the event of one or more buildings collapsing.

Plans are in place to improve or demolish some of the problem buildings by 2020 but this only covers about half of the inventory in question. Costs are currently estimated at about \$109 million for seismic upgrades with a total of \$400 million including other upgrades or demolition. The university says that 41% of its buildings were at risk of failure in the 1990s and that number has been reduced to approximately 11%. Funding and alternative locations for staff and students during upgrades are some of the impediments to completing the work.

An interactive map showing some of the buildings listed as very high or high risk with occupancy, proposed actions, costs and status is available on-line here: tamarabaluja.cartodb.com/viz/eb416de4-6700-11e5-8348-0ef24382571b/public_map

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apsc.ubc.ca/in-the-news/2015-09-30-000000/buildings-ubc-campus-assessed-high-risk-collapse-during-earthquake

www.cbc.ca/news/canada/british-columbia/ubc-earthquake-preparedness-1.3249599

www.vancouversun.com/news/buildings+risk+collapse+moderate+earthquake+report+with+video/11400080/story.html

MITIGATION & PREPAREDNESS

Los Angeles City Council Votes for Building Earthquake Retrofit Requirements

As part of Los Angeles City's "Resilience by Design" project, a new ordinance targets wood frame soft-story and non-ductile concrete buildings for mandatory retrofits. These types of buildings are considered some of the most dangerous to human safety during earthquakes. The ordinance was approved by Mayor Garcetti on October 9, 2015, and went into effect on November 22, 2015. It is estimated that approximately 15,000 buildings total (13,500 wood frame soft-story and 1,500 non-ductile concrete) will be affected by the new requirements.

The Department of Building and Safety (DBS) will be in charge of issuing "order to comply" letters to the owners of affected buildings. A courtesy letter will first be issued to building owners explaining the requirements. A first wave of compliance orders are expected to be mailed in February of 2016. Existing electrical, plumbing, mechanical or fire-safety systems are not required to be upgraded to comply with existing code unless they constitute a hazard to life or property.

The city is considering a number of possible ways to provide financial assistance for retrofits to building owners but nothing has been put in place at this time. Governor Brown vetoed a bill to provide a tax credit for seismic retrofits in October. Estimates are that wood apartment buildings may cost \$60,000 to \$130,000 to retrofit. Current law allows landlords to increase rent up to \$75 more per month to pay for the costs. Large concrete buildings may cost millions of dollars to become compliant.

An overview of the ordinance as related to the two affected building types follows.

Wood-Frame Buildings with Soft, Weak or Open-Front Walls

The ordinance affects buildings built under building code standards enacted prior to January 1, 1978, where the ground floor of the structure contains parking or similar open space with one or more stories above. Buildings are prioritized into three

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categories with those with 16 or more dwelling units having the highest priority. Buildings with three or more stories but fewer than 16 dwelling units are the second priority and all other units are the third priority with the exception of residential buildings with three or fewer apartments which are excluded from the ordinance.

The building owner has one year from a retrofit order to submit one of three options: a structural analysis and plans showing the building already meets the earthquake safety requirements, analysis and plans for the retrofit, or plans to demolish the structure. All permits for retrofit or demolition must be procured within two years and all work must be completed within seven years.



Above: Collapsed apartment building after the Northridge Earthquake of January 17, 1994.
Image: Gary B. Edstrom, released to public domain.

Non-Ductile Concrete Buildings

The ordinance affects concrete buildings built under building code standards enacted prior to January 13, 1977. Detached single-family homes or duplexes are excluded from the ordinance.

The building owner has three years to have a structural analysis of the building performed and submit a form and checklist to the DBS. If the building is determined to be non-ductile concrete, the owner must show that the building does not require retrofitting, has been retrofit, submit plans for retrofitting or submit plans for demolition within 10 years. All retrofit or demolition work must be completed within twenty-five years.

References:

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[retrofit-20151009-story.html](#)

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www.natlawreview.com/article/los-angeles-city-council-approves-major-earthquake-retrofitting-ordinance

www.scpr.org/news/2015/10/09/54942/los-angeles-council-expected-to-pass-costly-earthq/

California Earthquake Authority (CEA) "Earthquake Brace + Bolt" Seismic Retrofit Program to Expand in 2016

As reported in prior newsletters, California homeowners may be eligible to receive up to \$3,000 to retrofit their home's foundation. The first round of CEA funded retrofits are currently in progress in select areas but the program will add more than 150 new zip codes in southern California and the San Francisco Bay Area in January, 2016. It is anticipated that approximately 1,000 more homes could benefit from the newest round of retrofit funding.

The program focuses on the 2013 California Existing Building Code, Appendix Chapter A3 which provides prescriptive standards for seismic retrofits of existing residential buildings. Information on what homes may qualify for the funding is available on the website which has sections for homeowners, contractors and building officials. Typical candidate structures were built before 1979 with raised foundations and are built on level or low slope lots.

Specifically, the program can fund the following retrofit activities:

Bolt: add anchor bolts and sill plates in the crawl space to improve the connection between the wood framing of the house and its concrete foundation to help keep the house from sliding.

Brace: strengthen the cripple walls in the crawl space with plywood to prevent the house from toppling off of the foundation during an earthquake. Strengthening cripple walls enables them to function as shear members, significantly protecting the house from collapsing.

Strap the Water Heater: properly strap the water heater to reduce the likelihood of water and fire

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damage, and to protect the water supply.

Janiele Maffei, Executive Director for CEA's California Residential Mitigation Program is quoted as saying "It creates a more resilient California. The homeowner that can shelter in place after an earthquake is a homeowner who can get back on their feet financially quicker and be part of the reconstruction of the community rather than someone who's displaced for a year or more."

Registration for the expanded program will open in January. Further expansion of the program to more areas in California will depend on future funding availability.

References:

www.earthquakebracebolt.com/

abc7.com/home/1000-california-homeowners-to-get-funds-to-protect-homes-from-earthquakes/1090298/

www.kgoradio.com/2015/11/20/earthquake-retrofits-for-1600-homeowners/

ShakeAlert Earthquake Early Warning (EEW) System to be Tested in Los Angeles High School

The ShakeAlert EEW system's first deployment in the country for the general public will be in the Eagle Rock High School in the northeastern part of Los Angeles, California. Ten science classrooms will be set up to receive warnings of approaching earthquake shaking. Under the testing conditions, even earthquakes with low levels of shaking will alert the students so they can practice *Drop, Cover and Hold On* drills. As the USGS moves closer to making the system public, this phase will include testing different types of warnings, both visible and audible, to see which are the most effective.

The system has received limited beta testing since 2012; the Bay Area Rapid Transit (BART) rail system in the San Francisco, California area uses it to slow down trains prior to the main shaking of a quake. If fully funded the system could be operational in approximately two years according to Lucy Jones from the USGS.

ShakeAlert was developed by a coalition of cooperating agencies including the USGS, California Geological Survey, California Institute of Technology, California Governor's Office of Emergency Services, The Moore Foundation,

Southern California Earthquake Center, Swiss Federal Institute of Technology, Zürich, University of California, Berkeley, University of Oregon, and the University of Washington.

References:

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www.latimes.com/local/education/la-me-quake-early-warning-20151024-story.html

www.shakealert.org/

Montana Earthquake Mapper

Montana has a history of destructive and deadly earthquakes. However, the 1959, M7.3 Hebgen Lake earthquake, Montana's last major earthquake, occurred 56 years ago. This earthquake killed 29 people and caused \$11 million in damages (over \$88 million in 2014 dollars) to roads and bridges. Despite the huge financial and cultural impacts of this and previous major earthquakes, awareness of Montana's significant seismic hazards has largely faded from public memory. As part of an effort to raise public awareness of the very real seismic hazards in Montana, the Montana Bureau of Mines and Geology has developed a web-based mapping application that displays over 43,000 earthquakes recorded by the Montana regional seismic network since 1982. Also shown are significant historic earthquakes, potentially active faults and seismic hazard zones. This site allows the general public to explore their home towns and see the level of seismic activity, hopefully raising awareness and preparedness.

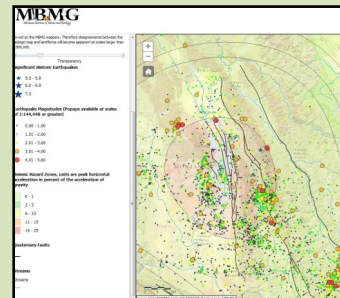


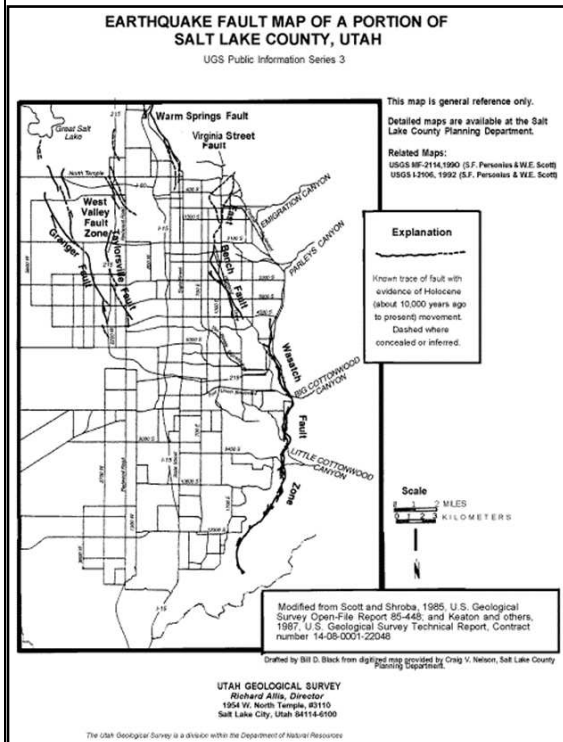
Image: Montana Bureau of Mines and Geology

Visit the MBMG mapper at URL:

<http://data.mbgm.mtech.edu/mapper/>

Submitted by Michael Stickney, Director, Earthquake Studies Office, Montana Bureau of Mines and Geology

Study of Taylorsville-West Valley City Fault Renews Utah Earthquake Preparedness Concerns



Researchers from the Utah Geological Survey are trenching the Taylorsville-West Valley fault to attempt to determine its seismic history and relationship to the Wasatch fault system. This research will help estimate future earthquake magnitudes, return intervals and inform building code development for the area. Previous studies have provided evidence of more than 20 past earthquakes near magnitude 7.0 over the last 6,000 years along the central area of the Wasatch fault.

This current research provides a backdrop for the “Scenario for a Magnitude 7.0 Earthquake on the Wasatch Fault-Salt Lake City Segment: Hazards and Loss Estimates” developed by the Earthquake Engineering Research Institute (EERI) for the Utah Seismic Safety Commission and released in June, 2015. The scenario was modeled using the HAZUS earthquake loss estimation program for a region including 12 northern Utah counties. Estimated losses include more than 84,000 households displaced, more than 2,000 deaths, short-term economic loss over \$33 billion and essential lifelines disrupted for days to months. The study area contains more than 147,000 unreinforced masonry buildings (URMs) which tend to be heavily damaged by earthquake shaking.

Image: files.geology.utah.gov/online/pi/pi-3.pdf

NOT prepared for a major Wasatch fault earthquake" and provides recommendations to the Utah Seismic Safety Commission to improve future earthquake resiliency. Bob Carey, Earthquake Program Manager for the Utah Division of Emergency Management and WSSPC member notes that a scenario type earthquake will cause a significant economic slowdown which will also impact recovery of the area. He points out that research such as the current trench studies provide improved data on the size and frequency of possible earthquakes in the future and also serves as a reminder to be prepared for the eventuality.

References:

www.eeri.org/projects/earthquake-scenarios/wasatch-fault-scenario/

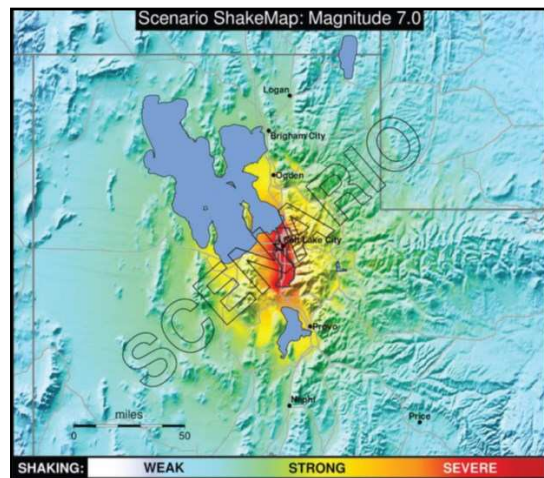
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fox13now.com/2015/09/05/researchers-studying-taylorsville-west-valley-city-fault-to-better-understand-quake-conditions-in-utah/

www.deseretnews.com/article/865636410/Geologists-sample-Taylorsville-West-Valley-fault-line-to-study-earthquake-risk.html

The Executive Summary for the scenario states that "Utah is NOT prepared for a major Wasatch fault earthquake" and provides recommendations to the Utah Seismic Safety Commission to improve future earthquake resiliency. Bob Carey, Earthquake Program Manager for the Utah Division of Emergency Management and WSSPC member notes that a scenario type earthquake will cause a significant economic slowdown which will also impact recovery of the area. He points out that research such as the current trench studies provide improved data on the size and frequency of possible earthquakes in the future and also serves as a reminder to be prepared for the eventuality.



Above: ShakeMap Scenario for a magnitude 7.0 earthquake on the Salt Lake City segment of the Wasatch fault

Image: www.eeri.org/projects/earthquake-scenarios/wasatch-fault-scenario

Mandatory Seismic Retrofit of Some Chimneys Recommended in San Francisco Study

As part of San Francisco's Earthquake Safety Implementation Program (ESIP), the report "Recommendations for Mitigation of Chimney Hazards", prepared by the Applied Technology Council (ATC), was released September 28, 2015. The report describes earthquake risk and policy recommendations based on an inventory of chimneys associated with wood-frame residential buildings in the city. Also included is a section on mitigation approaches appropriate to the building types found in San Francisco.

Failed masonry chimneys are one of the most common types of damage during an earthquake, even in relatively low levels of shaking. Besides the obvious hazard of falling chimney pieces which may harm humans or further damage the building (inside or outside), use of a cracked or damaged chimney may cause a fire or allow toxic fumes to enter a home. Any loss of habitability of residential structures due to preventable damage places an additional burden on post-quake recovery efforts.

An inventory was conducted and four common and distinct types of chimneys in San Francisco were identified. The report provides a matrix detailing the chimney types and associated risks and recovery. The estimated number of each chimney type and retrofit costs are listed below:

TYPE	ESTIMATED COUNT	ESTIMATED RETROFIT COST EACH
Patent flue (not considered a chimney for the study)	> 100,000	N/A
Setback house masonry chimney	~ 1,000 - 3,000	\$15,000 - \$25,000
Apartment building boiler masonry chimney	~ 500 - 1,000	\$10,000 - \$15,000
Victorian rowhouse masonry chimney	~ 45,000	\$25,000

The report suggests a combination of voluntary and mandatory retrofits to prevent or reduce the hazard. While most of the recommendations are for voluntary retrofit, the report notes that approximately 1,500 multi-story Victorian rowhouse masonry chimneys could collapse onto a street or sidewalk and should be considered for mandatory or triggered retrofitting for public safety. Patent flues are not considered significant contributors to falling hazards and suggested actions are limited to inspection for damage following a quake. Retrofit options include replacing all or portions of masonry chimneys with different materials while anchoring any remaining masonry to the structure, lowering of chimneys, and complete removal and replacement as some alternatives.

Four policy recommendations are presented: 1) Prepare for post-earthquake chimney inspections, 2) Encourage voluntary mitigation, 3) Mandate or trigger mitigation of public risks, and 4) Mandate or trigger replacement of apartment building boiler chimneys.

References:

www.sfexaminer.com/sf-earthquake-safety-group-recommends-seismic-retrofits-of-chimneys/

sfgov.org/esip/sites/default/files/FileCenter/Documents/13436-ATC-119_TaskA.4.g_ChimneyMitigation.pdf

National Earthquake Program Managers Meeting
National Earthquake Conference
Long Beach, California

SAVE THE DATES!
Week of May 2, 2016

earthquakeconference.org/



Above: Wood-frame building in Long Beach, CA destroyed by the March 11, 1933, earthquake. Image: USGS

RESILIENCE & RECOVERY

Portland, Oregon Moving Forward on New Water Pipeline to Withstand Earthquakes

A Cascadia earthquake could cut off water to as many as 130,000 customers on the west side of the Willamette River in Portland, Oregon. The potentially affected area could be without drinking water for up to six months and includes the city's downtown core and 3 major hospitals.

The existing water pipelines serving the area were built prior to today's knowledge of regional earthquake hazards. Some of the pipes lie within liquefiable soils while others run along a bridge that could fail, causing the lines to rupture.

The City of Portland Water Bureau plans to reduce the likelihood of this potentially catastrophic scenario by constructing a 42 inch diameter pipe 80 feet below the Willamette River, well below the liquefiable soil layers. The project, which is on the city's five year capital project list, is estimated to cost at least \$57 million and this cost has already been built into the utility rates.

The project is awaiting approval by the City Council to begin construction in 2017 with completion expected in 2019.

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koin.com/2015/12/04/pwb-wants-earthquake-safe-pipe-beneath-willamette/

Helena, Montana Receives FEMA Grant to Protect Water Storage Facilities During Earthquakes

The Montana Disaster and Emergency Services office is credited for assisting the city of Helena in procuring FEMA grant monies which will be used to install shut-off valves on its water storage facilities. These valves will prevent the potential loss of millions of gallons of potable water stored in tanks and reservoirs during an earthquake.

Retaining the water makes it available both for drinking and fighting fires that may start as a result of an earthquake.

According to the United States Geological Survey (USGS), Montana is one of the most seismically active states and Helena experienced a series of earthquakes in 1935 that caused four deaths and over \$4 million in damage.

The project cost of \$968,000 will mostly be funded by FEMA with the city contributing 25%. The work must be completed by March 1, 2016.

References:

helenair.com/mobile/article_fa8d4d6d-ecc1-5a8b-a65c-14aecc579b05.html

earthquake.usgs.gov/earthquakes/states/montana/history.php

J. Metesh, personal communication

RESEARCH

National Science Foundation (NSF) Invests \$40 Million in Natural Hazards Engineering Research Infrastructure

The NSF announced in September, 2015, that it is committing \$40 million to a network of seven university research facilities in the U.S. The Natural Hazards Engineering Research Infrastructure (NHERI) will focus on infrastructure resilience to earthquake, wind and water hazards. The program brings awareness to the interconnected nature of natural hazards; for instance, earthquakes can trigger tsunamis and landslides. Models, hazard data, results, and tools will be shared amongst the research facilities.

Earthquake-related testing for the NHERI program will occur at Lehigh University, University of California at Davis, University of California at San Diego, and University of Texas at Austin.

The NSF is a member agency of the National Earthquake Hazards Reduction Program (NEHRP).

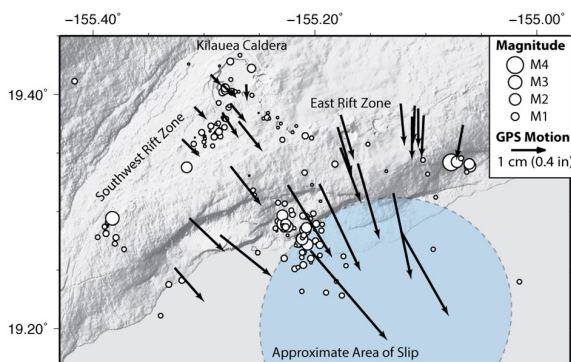
References:

www.nsf.gov/news/news_summ.jsp?cntn_id=136380

Slow Earthquakes Recur at Kilauea Volcano on Hawaii

Slow earthquakes have been occurring on the south flank of the Kilauea volcano on the island of Hawaii approximately every 26 months. These earthquakes are characterized by movement along a fault over a period of hour or days, rather than the sudden release of energy over seconds or minutes with accompanying shaking. The most recent slow quake started on October 14, 2015, continued for 2-3 days and caused a total of 1.2 inches (3 cm) of southeastward movement of the south flank towards the ocean. It was estimated that this amount of movement would have resulted in an earthquake of approximately magnitude 6 had it occurred quickly. Many small quakes, most under M3 were recorded Oct 15-17. The most recent prior slow quake occurrence was in May, 2012.

These slow quakes have been recurring on a fault boundary between the volcano and the ocean floor. Because of the repetitive events, the area has been outfitted with numerous tiltmeters and GPS devices to record the motions. Further study will investigate the possible relationship between slow earthquakes and other types of seismic activity within Kilauea's rift zones.



Above: Earthquakes (white circles) and deformation recorded by GPS instruments (black arrows) on Kilauea Volcano during the recent slow earthquake that began on October 14, 2015. The light blue circle shows the approximate area at about 10 km (6 mi) below the surface that slipped during the event. Image: USGS

References:

hvo.wr.usgs.gov/volcanowatch/view.php?token=8e1f192fe25ad49be764c3f55c68beb32f7aa66f85344

[e026b76cfaaa1d3d88a&id=303&__ncforminfo=pqa-l-nzA7il4bHNSzsRADJghpVPIFGqusyPHSd-saW9EaPE3ecDlaei8DYMCPmxQA5iJJynj_Ay9Mbi11GBA9qlif7TRssGL](https://doi.org/10.1101/011111)

www.researchgate.net/publication/237155814_The_2012_Kilauea_Volcano_Hawai'i_Slow_Slip_Event_Captured_by_cGPS_and_Satellite_Radar_Interferometry

Researchers Analyze Continental Transform Faults for Clues to Maximum Earthquake Magnitudes

A team of researchers from Germany and the United States evaluated 27 continental strike-slip faults worldwide in a quest to identify factors controlling the maximum magnitudes of earthquakes that could be generated on the fault. Earthquakes up to approximately magnitude 8 have been observed on these types of faults in the past. The San Andreas fault in California was one of the faults included in the study. Knowing the maximum possible event for a region could have significant impact on developing risk models, decisions of where and how to mitigate, build new structures, and plan for response after a quake.

Fault properties included in the study were: "...cumulative displacement, mapped fault length, seismogenic thickness, slip rates, and angle between fault strike and maximum horizontal stress." Seismogenic thickness is measured from the surface to the depths at which earthquakes are initiated and was based on estimates from hypocenter catalogs and GPS measurements. A challenge for the researchers was that instrumental earthquake records only go back about 150 years so historical records, trenches and other data were reviewed for relevant information about older major shaking events.

Results of the analysis led the researchers to divide the faults into two categories; both show a relationship between maximum magnitude, seismogenic depth, and cumulative displacement and between maximum magnitude and total mapped fault length:

Type A (75-80%):

- slip rate > 5mm/yr
- cumulative displacement > 10 km
- angle > 50° with respect to regional maximum horizontal stress

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Type B (20-25%):

- larger maximum magnitude than type A faults
- slip rate < 5mm/yr
- cumulative displacement < 10 km
- angle approximately 45° with respect to regional maximum horizontal stress

A possible explanation for the larger quakes on the type B faults might be that the Type A faults with more cumulative displacements were "smoothed" from multiple quakes and therefore rupture less violently. The Type B faults may undergo a more extreme change in stress level and release more energy when rupturing causing larger earthquakes.

References:

Patricia Martínez-Garzón, Marco Bohnhoff, Yehuda Ben-Zion, Georg Dresen, 2015: "Scaling of maximum observed magnitudes with geometrical and stress properties of strike-slip faults", Geophysical Research Letters, DOI: 10.1002/2015GL066478 (www.researchgate.net/publication/283684751_Scaling_of_maximum_observed_magnitudes_with_geometrical_and_stress_properties_of_strike-slip_faults)

<http://www.gfz-potsdam.de/en/media-communication/press-releases/details/article/wie-stark-koennen-erdbeben-an-verwerfungen-werden/>

Stanford Scientists Create Microquake Detecting Algorithm Inspired by Shazam

A new microquake identification technique called Fingerprint And Similarity Thresholding (FAST), developed by Stanford University scientists, was inspired by the Shazam music application which matches patterns from short sections of songs to identify them quickly.

Seismologists look for microquakes, quakes generally too small to be identified by conventional means, to get a fuller picture of the complete range of activity at a specific section of a fault. Better understanding of these smaller events may improve our ability to quantify the size and location of future earthquakes.

The most common method in use to identify these microquakes is "template matching" which compares a given seismic wave pattern against a database of previously recorded wave signatures. The FAST system overcomes two of the problems associated with template matching: it can look for

matching signals within a database without having a specific known signal to match to, and it is much faster. The speed comes from only matching sections of the signal that are a few seconds and have been compressed into "fingerprints" rather than matching the entire waveform. The fingerprints are compared and those that match can be traced back to their original record for occurrence times.

To test the system, the researchers analyzed and created a database from a week of data in 2011 from a seismic station on the Calaveras fault in California, where the fault had ruptured with hundreds of quakes. The FAST method confirmed the quakes and found many additional earthquakes registering below magnitude 1 that had not been identified.

Future work will center on analysis of longer time periods of data from multiple stations which will potentially allow epicenter location not possible using only a single station location.

References:

<http://news.stanford.edu/news/2015/december/shazam-for-earthquakes.html>

<http://www.nbcnews.com/tech/innovation/shazam-earthquakes-could-help-predict-big-quakes-n474331>

USGS Investigating Use of Twitter Postings (Tweets) to Improve Earthquake Detection

USGS seismologist Paul Earle and software developer Michelle Guy noticed that people often use short tweets to report feeling earthquake shaking. They developed the Twitter Earthquake Detection (TED) program to learn of earthquake events before the USGS official notification is made public. Using publicly available data from Twitter, they reviewed the types of tweets that were generated by those experiencing earthquakes and identified useful tweets as those with seven or fewer words. They discounted shared tweets as not likely to be a firsthand report. When many tweets from the same area with the word "earthquake" occur within a short time, the USGS receives an alert. The system is designed to pick up the word "earthquake" in many different languages and can be used worldwide.

Although USGS monitoring equipment picks up the ground motions quickly, the information goes through review and verification before being released to the public. USGS notification can take

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between 2 and 20 minutes depending on the type and density of sensors near the earthquake. Twitter data can be reviewed and provide an alert often within 2 minutes; the system picked up the 2014 Napa, California earthquake within 29 seconds. This method can be particularly effective in areas that are densely populated but have little or no earthquake monitoring equipment in the region and may serve as a form of earthquake early warning.

The researchers point out that while the TED provides fast notifications, it does not have the accuracy of the official USGS report, partially because many tweets do not include specific location information. What the system does do is to provide verification of an event prior to the official confirmation and details. It can also be used to provide an additional confirmation of false positives in the USGS detection system - no tweets in an inhabited location suggest no actual earthquake.

References:

blog.twitter.com/2015/usgs-twitter-data-earthquake-detection

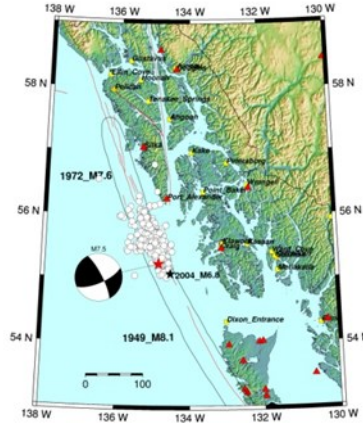
gallery.usgs.gov/audios/326#.VnCMhuLg_gQ

money.cnn.com/2015/10/07/technology/twitter-earthquakes/index.html

2013 Craig Earthquake Fills Seismic Gap on Queen Charlotte Fault

The M7.5 Craig earthquake occurred on the strike-slip Queen Charlotte Fault system in January, 2013 in a gap between the 1949 M8.1 and the 1972 M7.6 Sitka earthquakes. Average slip over the more than 62 mile (100 km) rupture length was 20 feet (6 meters). GPS measurements from the EarthScope Plate Boundary Observatory showed more than 1 inch of additional slip 1.6 years after the quake.

The Queen Charlotte fault system is located off the coast of Alaska and western Canada and is considered a boundary between the Pacific and North American tectonic plates. This event is believed to account for some of the overall motion between the plates.



Above: M7.5 Queen Charlotte Fault Earthquake of January 5, 2013

Image: www.aeic.alaska.edu/quakes/queen_charlotte_20130105.html

References:

www.aeic.alaska.edu/quakes/queen_charlotte_20130105.html

www.bssaonline.org/content/105/2B/1053.full.pdf+html

www.unavco.org/science/snapshots/solid-earth/2015/ding.html

ADDITIONAL RESOURCES & PUBLICATIONS

Basin and Range Province Seismic Hazards Summit III proceedings (January 12-17, 2015) are now available.

For more information: www.mapstore.utah.gov/mp15-5.html

American Geosciences Institute Critical Issues Program webinar "Communicating Cascadia's Earthquake Risk" video and presentation slides (October 16, 2015) are now available.

For more information: www.americangeosciences.org/critical-issues/webinars/communicating-cascadias-earthquake-risk

ATC/USGS Seismic Hazard User-Needs Workshop Presentations (September 21-22, 2015) are now available.

For more information: www.atcouncil.org/53-projects/278-atc-127

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Hazus-MH 3.0 was released by FEMA in November, 2015. The latest release requires ArcGIS 10.2.2. Hazus is a nationally applicable standardized methodology that contains models for estimating potential losses from earthquakes, floods and hurricanes.

For more information: msc.fema.gov/portal/resources/hazus

Performance of Buildings and Nonstructural Components in the 2014 South Napa Earthquake, FEMA P-1024/February 2015.

For more information: www.fema.gov/media-library-data/1427861387880-3ea85f352f1de10c7e07edf9ed561e7f/FEMAP-1024.pdf

Seattle Natural Hazard Explorer provides content from the Seattle Hazard Identification and Vulnerability Analysis (SHIVA) in an interactive web-based GIS tool.

For more information: seattlecitygis.maps.arcgis.com/apps/MapSeries/?appid=0489a95dad4e42148dbef571076f9b5b

South Napa Earthquake Recovery Advisory: Earthquake Strengthening of Cripple Walls in Wood-Frame Dwellings, FEMA P-1024/RA2/June 2015.

For more information: www.fema.gov/media-library-data/1439242021425-3b4c44f900c8893449327f0e764ef849/FEMAP-1024RA2.pdf

South Napa Earthquake Recovery Advisory: Repair of Earthquake-Damaged Masonry Fireplace Chimneys, FEMA P-1024/RA1/June 2015.

For more information: www.fema.gov/media-library-data/1439241984631-3b4c44f900c8893449327f0e764ef849/FEMAP-1024RA1.pdf

Temblor application shows seismic hazard in the United States. This free app was designed by former USGS geophysicist Ross Stein and cofounded with Volkan Sevilgen.

For more information: temblor.net/

There are so many ways to stay connected!



Online- www.wsspc.org

Twitter- [@WSSPC](https://twitter.com/WSSPC)

Facebook- www.facebook.com/WSSPC

PEOPLE & TRANSITIONS

2015-2016 WSSPC Board of Directors

WSSPC welcomes Karen Berry, Director of the Colorado Geological Survey and Colorado State Geologist and Mike O'Hare, Director of the Alaska Division of Homeland Security and Emergency Management as the newest members of the Board.

Dave Norman, Washington State Geologist, assumes the position as Chair.

Returning Board Members: Mark Ghilarducci, Secretary of the California Governor's Office of Emergency Services; John Metesh, Director of the Montana Bureau of Mines and Geology and Montana State Geologist; Peter McDonough, member of the Utah Seismic Safety Commission; and Brad Richy, Director of the Idaho Bureau of Homeland Security.

WSSPC Welcomes New Members and Representatives:

Caleb Cage, Chief, Nevada Division of Emergency Management

Dan Belanger, Earthquake & Tsunami Program Manager, Alaska Division of Homeland Security and Emergency Management

Theodora Meredith, Tsunami Project Coordinator, American Samoa Department of Homeland Security

Traci Pearl, State Hazard Mitigation Officer, State of Nevada

Dr. Lucy Jones Awarded Samuel J. Heyman Service to America Medal for Citizen Services

Dr. Lucy Jones of the United States Geological Survey (USGS) was one of eight federal employees who received the award, also known as a "Sammie", which recognizes excellence in the federal workforce. Dr. Jones "spurred communities and states to prepare for catastrophic earthquakes by applying her groundbreaking research and taking

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preventive measures to protect citizens and critical infrastructure." U.S. Secretary of the Interior Sally Jewell commented that "Besides conducting leading research on earthquakes, she turns complex scientific concepts into plain English, educating the public so they can take action to save lives and property."

For more information:

www.doi.gov/pressreleases/usgs-seismologist-lucy-jones-receive-prestigious-samuel-j-heyman-service-america-medal

servicetoamericamedals.org/

www.latimes.com/local/lanow/la-me-ln-earthquake-lady-lucy-jones-wins-government-service-oscar-20151006-story.html

2016 Alfred E. Alquist Medal Recipient Announced

Craig D. Comartin will receive the honor at the 2016 Earthquake Engineering Research Institute (EERI) Annual Meeting in San Francisco, California in April. Mr. Comartin is recognized as the driving force behind the *Concrete Coalition*, "a network comprised of individuals, governments, institutions, and agencies with an interest in assessing and mitigating the risk associated with dangerous non-ductile concrete buildings."

The Alquist Medal is awarded to an individual, company, or organization that has made substantial contributions to the field of seismic safety and earthquake risk reduction, having directly affected the seismic safety of the general population.

For more information:

www.eeri.org/cohost/member-resources/pulse

www.eeri.org/about-eeri/honors-awards/the-alfred-e-alquist-special-recognition-medal/

www.concretecoalition.org/

2015 Seismological Society of America (SSA) Award Recipients Announced

The Harry Fielding Reid Medal for outstanding contributions in seismology and earthquake engineering has been awarded to Christopher Scholz, Professor of Earth and Environmental

Sciences and of Applied Physics and Applied Mathematics, Columbia University and Lamont-Doherty Earth Observatory.

The Frank Press Public Service Award honoring outstanding contributions to the advancement of public safety or public information relating to seismology has been awarded to Walter Arabasz, Research Professor Emeritus, Geology & Geophysics, University of Utah.

The awards will be presented at the SSA Annual Meeting in Reno, Nevada in April 2016.

For more information:

www.seismosoc.org/awards/

www.seismosoc.org/news/ssa-press-releases/christopher-h-scholz-wins-top-honor-in-seismology/

www.seismosoc.org/news/ssa-press-releases/seismologist-walter-j-arabasz-honored-for-contributions-to-earthquake-safety/

Who are Members of the Western States Seismic Policy Council (WSSPC)?

The WSSPC is a non-profit consortia whose members are the directors of a total of 39 emergency management agencies, geological surveys, and seismic commissions from 18 states, provinces or territories. (See the map on the front page header or go to www.wsspc.org/members/). Oversight is provided by a seven member board of directors elected from the members.

The WSSPC office, located in Sacramento, California, is the administrative headquarters for the consortia and houses the Executive Director and Program Manager. In addition to running the day to day operations of WSSPC, the administrative office also administers FEMA funded State Support grants for projects as diverse as earthquake-related workshops, preparedness campaigns, response handbooks, and meetings. WSSPC also provides annual Awards in Excellence, Lifetime Achievement Awards, and Leadership Awards for those people and projects that have significantly contributed to addressing earthquake risk reduction.

Learn more about us at www.WSSPC.org.

CONFERENCES, WORKSHOPS & EVENTS

13th Annual Northern California Earthquake Hazards Workshop

January 26-27, 2016
Menlo Park, California, USA
<https://sslearthquake.usgs.gov/regional/nca/workshop/>

Science and Technology Conference on the Implementation of the Sendai Framework for Disaster Risk Reduction

January 27-29, 2016
Geneva, Switzerland
www.unisdr.org/we/inform/events/45270

Annual Federal Alliance for Safe Homes (FLASH) Conference

January 27-29, 2016
Orlando, Florida, USA
www.flash.org/2016meeting/

2016 PEER Annual Meeting

January 28–29, 2016
Berkeley, California, USA
peer.berkeley.edu/events/annual_meeting/2016AM/

68th EERI Annual Meeting

April 5–8, 2016
San Francisco, California, USA
www.eeri.org/2015/12/registration-open-eeri-68th-annual-meeting-april-5-8-2016/

Seismological Society of America 2016 Meeting

April 20–22, 2016
Reno, Nevada, USA
www.seismosoc.org/meetings/ssa2016/

2016 National Earthquake Program Managers Meeting

May 2–3, 2016
Long Beach, California, USA
www.earthquakeconference.org

2016 National Earthquake Conference

May 4–6, 2016
Long Beach, California, USA
www.earthquakeconference.org

ATC & SEI Second Conference on Improving the Seismic Performance of Existing Buildings and Other Structures Held in San Francisco, California

The conference brought together structural engineers, geoscientists and others from around the world for technical programs and presentations about building performance during earthquakes, seismic evaluation of buildings, and reducing earthquake damage through building retrofit.



WSSPC was proud to be a cooperating organization for this event.

For more information: atc-sei.org/

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If you have a newsworthy item for our e-Newsletter, please forward it to
Johanna Fenton, Program Manager at: news@wsspc.org