

**Adopted Minutes
Utah Seismic Safety Commission
Quarterly Meeting Minutes**

On April 26, 2018, a regularly scheduled quarterly meeting of the Utah Seismic Safety Commission (USSC) was held in the Kletting Room of the Utah Senate Building in Salt Lake City, Utah. Chair Leon Berrett called the meeting to order at 9:00 a.m.

Members Present:

Leon Berrett, Chair	American Public Works Association
Rick Allis, Vice Chair	Utah Geological Survey
Kris Pankow (designee for Keith Koper), Vice Chair	University of Utah Seismograph Stations
Roger Evans	Utah League of Cities and Towns
Peter McDonough	American Society of Civil Engineers
Patrick Tomasino	Utah Division of Facilities and Construction Management
Steven Bruemmer	American Institute of Architects, Utah Disaster Assistance
Meldee Love	Utah Insurance Department
Gerald McKenzie	Structural Engineers Association of Utah
Bob Carey (designee for Kris Hamlet)	Utah Division of Emergency Management
Joaquin Mixco	Utah Department of Transportation
Evan Curtis	Utah Governor's Office

USSC Staff Present:

John Crofts	Utah Division of Emergency Management
Adam Hiscock	Utah Geological Survey
Emily Kleber	Utah Geological Survey

Guests Present:

Walter Arabsz	Commission Advisor
Glen Palmer	Palmer Engineering
Brent Maxfield	The Church of Jesus Christ of Latter-day Saints
Kevin Franke	Brigham Young University
James Pechmann	University of Utah Seismograph Stations
Dave Isleman	U.S. Bureau of Reclamation
Eric Martineau	Utah Division of Emergency Management
Jim Higbee	Utah Department of Transportation–Geotechnical Division
Jerry Thompson	West Valley City

Members Not Present:

Representative Gage Froerer	Utah House of Representatives
Chris DuRoss	U.S. Geological Survey (Ex-Officio)
Senator Jerry Stevenson	Utah State Senate
Craig Kerkman	Association of Continuity Professionals

Welcome and Introduction of Members and Visitors/Approval of Minutes

Leon Berrett made introductions, recognized guests, and presented the minutes from the previous meeting.

Joaquinn Mixco made a motion for approval of the January 18, 2018 meeting minutes.

Steve Bruemmer seconded the motion.

Rick Allis pointed out one small correction and mentioned the minutes were very complete. Meeting minutes were approved with correction.

Utah Geological Survey (UGS) Levan and Fayette Segments, Wasatch Fault Zone (WFZ) Paleoseismic Investigation and WFZ Mapping Project Update

Emily Kleber updated the Commission on UGS progress with the National Earthquake Hazards Reduction Program (NEHRP)/U.S. Geological Survey (USGS) Earthquake Hazards Program which funds trenching, mapping, and other projects that help reduce earthquake risk. This is a process they revisit every year. She explained that last year they were very successful and received funding for three projects. Typically, only one or two projects are funded. The Levan and Fayette segment paleoseismic trenching project that Adam presented at our last USSC meeting was funded, along with the 2018 Utah Earthquake Working Groups, and mapping of the East and West Cache fault zones. She explained these projects are timely, because the USGS is updating their seismic hazard model in 2019, and products from these investigations can be incorporated. She said they recently completed the Wasatch fault zone mapping of about 210 miles, and submitted their final report to the USGS. There are 39 new maps and they are working on publishing them. The publishing will take place online, and these improved maps will have higher detail and resolution, and provide greater value because of the increased detail. They anticipate the new maps to be published this summer. These new detailed maps will also include Special Study Zones where fault trenching investigations are recommended before construction. This will dramatically help communities with planning and zoning. Consultants and other users will use these detailed maps in a variety of ways that will further reduce earthquake risk. After these maps are published they will conduct outreach to communities. She said these new maps include definitions of Special Study Zones and fault trenching investigations. This new information will better assist parties to understand the hazards of building in sensitive areas.

Finally, they are working on detailed mapping of the East and West Cache fault zones, which is ongoing this summer, with similar high-resolution lidar topographical data. This will help them pinpoint the faults in Cache Valley, and help to delineate accurate Special Study Zones in Cache Valley. They are hoping to complete this mapping before development occurs in these sensitive areas.

The next proposal cycle will likely include: the 2019 Utah Earthquake Working Group meetings in February, a Clarkston Mountain segment paleoseismic investigation, and similar mapping that focuses on the Bear Lake and west side of the Oquirrh Mountain areas. These are areas where continued growth is anticipated.

Barry Welliver complimented the projects and asked about community outreach.

Emily described their process of reaching out to communities by emails, personal visits, and one-on-one outreach, which includes discussions on obtaining available geotechnical reports. It is up to the communities on how they use this information.

Leon added that the Commission can assist in presenting materials because the Commission consists of key players. He suggested special invites to area engineers, the American Public Works Association (APWA), Structural Engineers Association of Utah (SEAU), Earthquake Engineering Research Institute (EERI), and other organizations. He also discussed electronic copies and paper copies.

Emily clarified that these would be primarily electronic and that it takes a long time to prepare paper maps.

Rick said that their office could provide paper maps and has the capability to get both electronic copies and paper copies through their bookstore.

Leon suggested they print paper copies that they could use to demonstrate the maps. He said it could help with NEHRP reauthorization by demonstrating the maps to elected officials. He asked Emily if she could present in our July meeting to demonstrate the maps.

Adam Hiscock suggested presenting later so they could assure the maps are completed. He led a discussion about presenting at the next Commission meeting or even in the fall.

Adam discussed the digital map details would be 1:10000. With that scale you can really zoom in quickly for very detailed review. He said that paper maps with that high of a scale could take 35 maps and literally turn them into 2,000 maps because of the excellent detail.

Leon suggested we print a few detailed maps for demonstration purposes to elected officials.

Shakeout and Other Activities

Leon updated the Commission about a joint Utah Department of Transportation (UDOT) and Salt Lake County Public Works exercise on May 10, 2018. He invited everyone to participate. UDOT crews and Salt Lake County employees would meet conduct the joint exercise. The exercise will begin 7:30 a.m. They will get an 8:00 a.m. briefing, mission assignments, and be assigned rotations for debris management. The exercise will conduct a mock setup with Unified Police Department, the Salt Lake County Health Department, and Unified Fire Urban Search and Rescue. The exercise will include a demonstration on debris removal. They will use snowplows for debris removal and exercise clearing roads of nails and other debris. UDOT is filming the exercise and will use the video to help train their staff. The exercise also includes the Utah Division of Emergency Management (DEM) and Salt Lake County Emergency Management. Multiple public information officers (PIO) are participating. This is open to all public works entities and others who participate in mutual aid agreements involving Salt Lake County.

Joaquin Mixco said they are taking this exercise seriously to prepare for an earthquake. He said the focus is on learning the basics of the Incident Command System (ICS) and working with people you typically do not work with to address an earthquake. Learning how to work in an ICS, exploring your own opportunities to come together, and work with like-minded professionals is vital. He suggested reaching out to other associates to understand the concepts of Incident Command.

Leon said this exercise is exciting and hopes they can build on this exercise and further strengthen partnerships in the future. They hope to link this with Great Utah Shake Out and hold this exercise every year.

Bob Carey discussed the Shakeout at the State of Utah. He discussed the evacuation, radio checks, and our staff exercises. The Lieutenant Governor participated in this exercise. Participation this year exceeded 975,000 participants. The Commission members discussed practicing and finding system deficiencies through these exercises and finding potential failures in systems.

Meldee Love said that the Utah Insurance Department participated in the Great Utah Shake Out, and that the Department has been conducting Great Shake Out exercises that included pushing out exercise games. These exercise games increased participation she said that this year people were excited to be involved.

Wasatch Front Ground Motion Modeling Proposal Ideas

Brent Maxfield welcomed and introduced Dr. Kevin Franke. Dr. Franke conducts drone reconnaissance flights that he films damage soon after earthquakes.

Dr. Franke discussed the 2017 magnitude (M) 8.1 earthquake in Mexico City which was then followed by another M 7.1. Some of the things they have learned from Mexico may be directly related to Utah. He led a team that was in Mexico only five days after the earthquake. He provided a review of Mexico City and described the city's geography and geologic history. He discussed the earthquake of 1985 which caused massive structural collapses throughout Mexico City. After 1985, researchers studied the frequency of vibration of those natural periods of vibration across the valley in Mexico City. They identified seismic zones and based on the frequency of the ground on which the zones are based. In the 2017 Mexico City earthquake, some of these zones had a correlated building failure with the seismic zones. He discussed Zones 1-4 which they currently use in Mexico. He discussed the zones and longer and shorter period soils and how they affect buildings. Zone 2 is a "transition zone" between sand and rocks (transition from lake to the mountains). Zone 2 represented a significant level of building failure.

He presented a map of the earthquake zones and building failures in the zones delineated. A large portion of failed buildings were in Zone 2. Earthquakes hitting Mexico City and particularly building in Zone 2 or the "transitional zone" were hit particularly hard and had the highest building failure.

Bottom line is that they know structures are most heavily damaged when they are in tune with the earthquake frequency and that they vibrate like crazy. He discussed when watching TV there is may be a buzzing of objects in the room. These objects are vibrating at the same frequency as the sound coming from the speakers. This is called resonance. In the end, he believes the structures that are most damaged are those that are "in tune" with underlying earthquake frequencies. Three things affect buildings in earthquakes:

1. Resonance,
2. Structures in tune with underlying soil, and
3. Ground motions over a range.

When all three of these effects line up, there is a potential for trouble. Dr. Franke mentioned we can focus on those areas and those structures. He also stated that we can prevent structures from

being built in tune with natural conditions. He and Professor Clint Wood from the University of Utah are looking at putting together a proposal to study these along the Wasatch Front.

Structural resonance has three components they would propose to study:

1. Systematically measure and map the ambient site period throughout the Salt Lake Valley,
2. Provide remote sensing information to estimate and map the structural periods across the entire valley, and
3. Compare the site period maps with structural period maps and identify structures that are in tune with the soils in which they are constructed.

He described the seismometer instrument used and explained the process for finding the frequency of the soils and hopes to map the Salt Lake Valley in 1-2 kilometer grid spacing within one year. He wants to take advantage of the existing lidar elevation data set and incorporate the data into the study. He suggested starting with lidar data and subtract the bare earth model, which will provide building height. The first phase of the study is to estimate building height. As far as bridge estimates are concerned they will work with the Utah Department of Transportation (UDOT) to get bridge data. He said the study will benefit engineers and be a tremendous tool. Resonance will occur it will be an intermediate step and be a nice filtering tool to tell which area they want to do a more in-depth study. You should not build these types of structures in this area. He said the proposed plan will need \$130,000 to \$150,000 to complete the study. They are going to request \$85,000 from NEHRP and he hoped he could approach the Commission about the possibility of providing state funding to supplement the NEHRP funding. The due date for the proposal is May 22, 2018. He asked the Commission for ideas for ways to ask for ideas to fund the matching.

Leon asked for questions or comments and thanked him for presenting. He said this is old science and perhaps this could assist with disasters and that perhaps this study could be useful in handling earthquake mitigation in a different way. He said the Commission could perhaps provide a letter of support, but that the Commission cannot provide funding.

Barry suggested to crowd-source this to help get funding. He asked about lidar and its usefulness when Salt Lake County has already extracted the heights for every building.

Dr. Franke said they could and will utilize building height data, but that lidar is a matter of efficiency. He said the lidar would tell how tall buildings are and not how tall buildings “should be”. He did follow up and agree that they should check all the data. They want to get every building for every section in the county accurately modeled.

Kris Pankow described her participation in the panels that review NEHRP proposals. She said that she has sat on the panels over the course of many years and they have never addressed matched funding as a criterion for a proposal being accepted. She encouraged Dr. Franke to concentrate more on the merits of the proposal rather than the funding match. She explained to him to ask “do you meet the standards set out in the proposal requirements. Can you show the work you are doing will reduce the risk? Are you bringing the best science that will reduce earthquake risk?” She told him he has a good argument and suggested he look at the study being completed in two years—not one year. She recommended from her experience that if he can provide a strong argument for earthquake risk, then State or “matched” funding is only a secondary issue. She continued by explaining the primary focus of the panels is to demonstrate your benefit—and not the cost. She encouraged him to ask, “Are you bringing the best science

that will reduce earthquake hazards?” She encouraged him and told him he had a very good argument, and reemphasized that he change the timeline from one to two years.

Rick encouraged him to show some of his own cost share and to technically show your cost share on paper which would help.

Walter Arabasz explained that standing committees [Utah Earthquake Working Groups] are funded in part by UGS and that two relevant points are that standing commissions provide technical information that can be used as support, and that in effect is providing technical information supported by the USGS. He suggested that the study represent what is needed in the state of Utah and provided advice for a technical proposal.

Dr. Franke said that the white paper that was being passed out was still in draft form and they would appreciate it if it were not distributed. [Note that materials distributed at a public meeting are not confidential, unless meeting specific requirements of the Utah Open and Public Meetings Act.]

Walter provided feedback and advice to circulate the proposal for feedback among the Commission.

USSC Trifold Pamphlet

Leon discussed creating a trifold pamphlet that discusses the Commission and demonstrates useful information regarding the Commission. He passed out a draft trifold. There was some discussion and recommendations for improvement. He proposed a goal to have a better draft copy prepared by the next meeting.

Adam said he spoke to his editorial staff and that UGS would use their staff to create a professional brochure.

Leon suggested meeting the end of May to better develop a draft.

Legislative Updates

Kris discussed the USGS budget that was recently passed. She said \$27.1 million additional funding was passed. Over \$8 million is to rebuild Puerto Rico’s seismic network. Most of the additional funding is for early warning earthquake systems and for the hardware required to process the alerts. She said that there is also money for central and eastern U.S. seismic networks. There is funding for adopting Earthscope stations, primarily in Alaska. There is \$5 million specifically targeted for upgrades and replacement equipment and \$5 million targeted for upgrades that may go to the Intermountain West. There will not be funding for new stations. University of Utah Seismograph Stations (UUSS) were asked to submit their priorities. Much of Strong Motion Network was installed prior to 2003, and it is fairly old at this stage. UUSS priorities are as follows:

- Replace 32 Kinometrics K2s and 29 mimic Celimomintors along the Wasatch Front.
- Replace “End of Life” cell modems and phones and prepare for IP6 (telecommunications and encryption).
- Transition their core processing ANSS Quake Monitoring Software (AQMS) system from Solaris to Linux. This would keep them all operating on the same software throughout the country.

- Upgrade the Advanced National Seismic System (ANSS) broadband system and replace the data loggers and broadband sensors.
- Begin upgrade of analog stations to digital.

The UUSS does not have details or information on funding.

Walter asked if the new systems will be compatible in the future with early warning systems.

Kris said yes that they will provide the sensor data. Most of the new equipment is being designed to be compatible.

Building Codes (Discussion)

Leon introduced Brent Maxfield, a structural engineer from The Church of Jesus Christ of Latter-day Saints.

Brent talked about the basics of seismic design in our current building codes adopted in Utah (2015 International Building [IBC] and Residential [IRC] Codes). He demonstrated some earthquake videos and discussed magnitude of earthquakes and what it means. Magnitude is the release of energy and that energy affects an area. Magnitude can determine the duration of an earthquake. Ground shaking could range from 1 to 6 minutes depending on the magnitude of the earthquake. Ground shaking intensities may not be measured from magnitude. Small magnitude earthquakes can have higher ground shaking intensities than anticipated. It is important to understand what the shaking intensities are. He demonstrated ground shaking intensities and discussed them from I to X. As shaking increases, the damages increase. Brent discussed ground shaking can cause damage even to modern buildings.

Kris made a clarification on the Modified Mercalli Intensity (MMI) scale and clarified that the building would respond on this scale and not the direction of the quake and discussed the scale system and how it relates to building performance.

Pete McDonough referenced the formulas that correlate with MMI and accelerations and that you can get a general number. He commented that increased acceleration tends to increase damages.

Kris provided clarification so as to avoid any confusion.

Brent discussed some hypothetical events regarding magnitude and ground shaking intensity. He stated that understanding magnitude and intensity shows the real picture of an earthquake. He discussed the statistical probability of when the next earthquake will occur. He said you cannot tell the ground motion in a M 7 over a given area. We know different locations will have different motions. Ground shaking is most likely to occur between these ranges. Many things affect ground motion. The current, adopted IBC and IRC building codes are not based on specific magnitudes, but other values. Where are we going to design buildings? Brent explained that MCER stands for maximum considered earthquake risk. He discussed that it is not an earthquake—it is ground motion. Each place in the United States is different. The higher the probability of damaging earthquakes, the higher the MCER. Discussed the specific probability of large shaking ability in area. Discussed a 1 in 5000 chance of building collapse. We do not have to have a 10% chance that the building will collapse. The code does not require building for MCER. Discussed Mexico City and their earthquake and how Mexico uses the MCER. Design Shaking Intensity... Discussed buildings designed for withstanding shaking intensity and suggested hospitals and other buildings should withstand shaking intensity so buildings are not damaged. Message is all about the shaking and the quake. We cannot say we are designing for a

M 7 because of the variability of shaking intensities. We could have the same earthquake and have different areas in the valley with different shaking intensities with variable shaking intensities. He discussed the codes and the MCER versus the USGS and the 84 percentile values. How much larger could the shaking be if we have a Wasatch fault event? What impacts will that have and how many pockets of the Wasatch fault will have greater shaking events. Want to put together a study that would come back with recommendations. What the building code does and does not do.

Leon opened it up for discussion.

Jim Higbee discussed categorizing UDOT's bridges.

- I. Critical bridges remain operational
- II. Essential can be repairable
- III. Designed that they do not collapse

Brent discussed the probability of when the Wasatch fault will rupture. He said the last time was 1,250 years ago. The probability is that an earthquake will return 1,200 years after the last earthquake. The Wasatch fault is sufficiently strained (right now) to have another event. In terms of engineering they say it is a "roll of the dice". He said engineers do not have recommendations, but they are working to narrow earthquake prediction estimates. [See Earthquake Probabilities for the Wasatch Front Region in Utah, Idaho, and Wyoming: Utah Geological Survey Miscellaneous Publication 16-3, http://ugspub.nr.utah.gov/publications/misc_pubs/mp-16-3/mp-16-3.pdf for the latest consensus-derived probability data.]

Barry clarified the collapse risk of unreinforced masonry buildings (URM).

Brent indicated that URMs present a higher risk of collapse.

Bob asked how much it costs to seismically retrofit a single family dwelling to meet earthquake standards.

Brent said the cost is minimal.

Dr. Franke said that liquefaction of residential structures is significant. Choosing to ignore the risk of liquefaction could be extremely costly. Liquefaction resulting from the Christchurch, New Zealand earthquake cost over \$2 billion in damages to residential structures. Reinforced concrete beams or running beams below basements would cost an estimated \$5,000 during construction.

Pre-Disaster Mitigation Grant Program (PDM)

Eric Martineau said the competitive PDM program receives an annual allotment of funds. Last year, Utah received \$3 million for three projects. They included a generator in Saratoga Springs, a detention basis in North Ogden, and continued funding of Salt Lake City's Fix the Bricks program. This year, *Fix the Bricks* has funding for over 200 homes and estimates that 68% of the buildings in Salt Lake City are URMs. Their focus is on single family homes with new roof replacements. Typically, PDM nationally receives between \$25-90 million per year. This year, the 2018 budget is estimated to be \$250 million. PDM grants extends to any mitigation project—not just earthquake hazards.

Pete asked what the typical work is done with *Fix the Bricks*. Clarification was provided that it typically consists of roof to wall connections, chimney bracing, and other appendages.

Other Updates

Bob discussed the National Earthquake Program Managers meeting in Seattle and discussed the benefits of the meeting and what was accomplished. The meeting provides an opportunity for states to share success and failures from their programs with each other. Additionally, it provides the sharing of information from NEHRP agencies and Federal Emergency Management Agency (FEMA) regional offices along with the earthquake consortia.

Pete discussed the Western States Seismic Policy Council (WSSPC) annual meeting. WSSPC includes individuals from the western United States, western Canada, and the Pacific island territories. He discussed his participation as the WSSPC Chair and discussed other committees he oversees in WSSPC. The group puts together policy recommendations that are used by legislative bodies to create new laws. This year we are voting on four policy recommendations: earthquake and tsunami planning scenarios, earthquake tsunami risk reduction strategies, definitions of surface faulting, and the identification and mitigation of non-ductile concrete structures in the Basin and Range. He said the upcoming policies for discussion next year are:

- Effective rapid tsunami identification.
- Post-earthquake technical clearinghouses.
- Evaluation and remediation of school buildings.
- Reliability of lifelines.
- Earthquake activated automatic shutoff of gas pipelines.

Leon discussed the recent EERI Clearinghouse Workshop. He gave a presentation about the USSC and what activities the Commission has engaged in. He mentioned that Bob provided a presentation and that he and Bob participated in a panel discussion.

Bob gave a brief history of clearinghouses from various disasters and discussed the effectiveness of clearinghouses during the Northridge, California earthquake. This earthquake set the foundation for what we have today. He discussed Washington State and their clearinghouse, which has started us down the path of having successful clearinghouse.

Bob discussed meeting with the Utah Insurance Commissioner. The meeting was called by the Utah Division of Risk Management to discuss the State of Utah's insurance and exposure. Right now, our policy covers only \$500 million, because Utah is self-insured. A proposed policy covering \$2 billion loss would cost our State \$18 million per year. Bob said FEMA wants to see an earnest effort by the States to help cover disaster losses and an effort to mitigate future losses. At some point, FEMA will step in to help with a 75/25 match, 75% coming from the federal government. Changing the building code would help us mitigate our losses. He asked where the balance of an insurance premium and mitigation is. Bob said there is no answer for that, but indicated that over \$18 million can go out the door every year for an event that does not happen. Right now, Utah is paying \$2 to \$3 million every year for small insurance policy.

Meldee mentioned that the Utah Insurance Commissioner is very knowledgeable and that the public is going to want to return to normal quickly. Insurance is key to helping people return to normal. She discussed economic repercussions of people fleeing and not returning. To get people to come back, insurance companies can step in and help them recover. She asked what buildings are critical to bring life back to normal. When the public is confident that people are stepping in to help, then they will be more confident to stay. She said if just 50% of a population evacuates, the State could not recover and the State cannot afford to let this happen.

Bob said when the earthquake happened in San Francisco, the officials said most of the damage was from fire. This was a concerted effort to say the earthquake did not do the majority of the damage. It was the fire that caused the majority of the damage. He said fire damage is easier to repair than earthquake damage. He mentioned that half of the population of San Francisco rotates out every five years. So they do not really understand the earthquake risk.

Barry asked the question if the Governor or Lieutenant Governor seemed to have an economic grasp of the potential damages.

Bob says we are in our infancy of looking at insurance. He said DEM is aware of the FEMA programs, but he is not sure how to resolve this insurance issue.

Leon mentioned that it appears we are underinsured; however, when you look at FEMA assistance, there is some assistance available.

Pete asked about the earthquake scenario economic losses.

Bob said the economic losses have grabbed stakeholder's attention. The next HAZUS run has three times more economic losses than the last report. He discussed the new economic losses with FEMA and where were the losses coming from. The increase of losses are coming from new census data, better county assessors data in the area of square footage increases, and higher replacement costs.

Bob gave an update on the URM Committee for Nevada and discussed a proposed two-day URM workshop in Reno, Nevada. Their URM committee was talking about having this workshop next year.

Bob discussed the upcoming Rapid Visual Screening for Schools meeting in which they hopefully will get the final report of the work performed by Reaveley Engineering.

Bob mentioned that the next meeting there will be annual elections for the Commission Chair and Vice Chairs.

Leon said the Commission should do letters of support for Dr. Franke.

Pete asked if we need to take a vote and then he made a motion of support for the letter to Dr. Franke.

Bob seconded the motion and it unanimously passed.

Leon discussed his participation in the Emergency Management Assistance Compact (EMAC). He said he will share with the Commission EMAC information from his continued participation.

Leon stated the next meeting is tentatively scheduled for July 19, 2018, in the Kletting Room at the State Capital Senate Building. Details will follow.

Bob made a motion to adjourn.

Roger seconded the motion and the meeting was adjourned.