Utah Seismic Safety Commission
May 7, 2020 Quarterly Meeting Minutes

On May 7, 2020, a regularly scheduled quarterly meeting of the Utah Seismic Safety Commission (USSC) was held virtually on account of COVID-19. Chair, Leon Berrett, called the meeting to order at 9:00 a.m.

Members Present:

Leon Berrett, Chair	American Public Works Association
Steve Bowman, Vice Chair	Utah Geological Survey
Keith Koper, Vice Chair	University of Utah Seismograph Stations
Kris Hamlet	Utah Division of Emergency Management
Roger Evans	Utah League of Cities and Towns
Jessica Chappell	Structural Engineers Association of Utah
Steven Bruemmer	American Institute of Architects, Utah Disaster Assistance
Patrick Tomasino	Utah Division of Facilities and Construction Management
Peter McDonough	American Society of Civil Engineers
Evan Curtis	Utah Governor's Office Planning and Budget
Meldee Love	Utah Insurance Department
Joaquin Mixco	Utah Department of Transportation
Chris DuRoss	U.S. Geological Survey (Ex-Officio)
Sean McGowan	Federal Emergency Management Agency (Ex-Officio)

USSC Staff Present:

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

Guests Present:

Barry Welliver	Earthquake Engineering Research Institute
Jim Pechman	University of Utah Seismograph Stations
Mark Hale	University of Utah Seismograph Stations
Kyle Becker	Utah Insurance Department
Brent Maxfield	Utah Citizens for Seismic Safety

*Please note other guests were present and not identified, due to meeting being held virtually.

Members Not Present:

Craig Kerkman	Association of Contingency Professionals

Welcome and Introduction of Members and Visitors/Approval of Minutes

Leon Berrett made introductions and invited attendees to introduce themselves.

Approval of Minutes

Leon asked for a vote on the approval of the minutes from the January 23, 2020 Utah Seismic Safety Commission meeting and the Fourth Quarter Joint Utah/Nevada meeting.
Evan Curtis made a motion to approve the minutes for July 23, 2020.
Steve Bowman seconded the motion to approve the minutes. The minutes were approved.

Patrick Tomasino made a motion to approve the Fourth Quarter Joint Utah/Nevada meeting minutes.
Evan Curtis seconded the motion to approve the minutes. The minutes were approved.

Keith Koper provided a presentation on the magnitude (M) 5.7 March 18, 2020, Magna, Utah, earthquake. He discussed the University of Utah Seismograph Station's (UUSS) role and participation with the earthquake sequence. He recognized his staff and the many participants who tirelessly worked on this sequence. He discussed the 203 seismograph stations statewide and the resulting digitized data. He explained the strong motion seismometers and their advantages and discussed details regarding their excellent performance. He reported that there were 40,000 public responses to the UUSS and U.S. Geological Survey (USGS) *Did You Feel It* webpage from people who reported the earthquake. His presentation showed maps of the earthquake and explained the color coding, and that warmer colors indicating stronger shaking. He reported their data was communicated quickly to all parties and that even the Governor's notes, soon after the earthquake, included one of their shakemaps that they quickly pushed to partners. He shared a map of the seismometers showing the strongest motion and acceleration. They successfully captured strong motion data sets and he explained that this data is excellent because of the infrequent earthquakes along the Wasatch Front. He continued that this is a decades-long experiment which provides data and information that is provided to many earthquake related professionals from building engineers to building code inspectors. They feel good about the excellent data that they were able to capture.

Unreinforced masonry buildings (URM) experienced the greatest amount of damage. He demonstrated an analysis of the earthquake and explained that it first showed as a M5.7. Later, they estimated that it was closer to a M5.5; however, to avoid confusion they will leave it at M5.7. The duration of mainshock was two seconds. The amount of motion called slip was about 1/3 of a meter. Over the course of two seconds, the slip occurred underground over about 20 square kilometers. The energy disperses and spreads out from the hypocenter. He explained that it was a high-pressure response because they were working from home. Although the quake lasted two seconds, it was felt longer because of the big ripples that spread out—like a stone being thrown into water. After the quake, they were able to get out 185 temporary seismometers withing a week of the main shock. He discussed the various types of seismometers and how they perform. Placing extra seismometers helps because they can do a better job detecting smaller aftershocks. As of yesterday, there have been 2,017 aftershocks. He discussed two particularly large aftershocks and described these aftershocks as typical of an aftershock sequence. He discussed the Magna cluster and the cluster south of

the Salt Lake International Airport and that they are both from the same sequence. He discussed some of the aftershocks register below zero because of the logarithmic scale and sensitivity of the equipment. This M5.7 earthquake is the largest on the Salt Lake City segment of the Wasatch fault zone (WFZ) that we have experienced with modern instruments. He discussed the WFZ and antithetic faults and how they may affect each other. He showed this as a very complicated fault zone.

- Important take-home points were that this M5.7 earthquake was moderate sized, but if we have a M7 earthquake, then we would experience a release of energy that represents 90 times more energy than this moderate M5.7 quake.
- Only a small amount of stress was relieved on the northern edge of Salt Lake City segment; however, the segment is still capable of producing an +M7 earthquake.
- The recurrence interval for large earthquakes (M>6.75) on the Salt Lake City segment is 1,300-1,500 years, the last large event occurred about 1,400 years ago.

Jessica Chappell asked for clarification on the duration of the quake.

Keith explained that with larger earthquakes the shaking continues much longer. He discussed resonance of the buildings are affected from the sediments and other factors. The shaking can continue longer because of location and resonance. Looking at how these things vary, versed on the site location and how the duration varied. The vertical force can be stronger as well. If we have a M7 on the Salt Lake City segment, it could potentially have longer duration shaking because of resonance and other factors.

Chris DuRoss asked about the difference in submissions of the lower angle and USGS solution and the opinion regarding the two different solutions.

Keith Koper said he had seen five different solutions in the main shock. He discussed outliers and other factors. He said the Utah Geological Survey agree with the UUSS interpretations. He discussed some of the possible interpretations of the different solutions from the differences because of speed and accuracy accounting for differences.

Steve Bowman, Emily Kleber and Adam Hiscock

Steve discussed the Utah Geological Survey (UGS) participation with the UUSS and the Utah Division of Emergency Management (UDEM). The M5.7 mainshock occurred on March 18th, 2020. By 9:00 a.m., their Emergency Operations Center (EOC) was activated, and field teams were being mobilized. By 9:20, the digital clearinghouse was set up that includes photographs, reports, and other information that is shared with other partners, agencies, the media, and the public. Emily Kleber, Adam Hiscock, Jessica Castleton, Rich Giraud, and Greg McDonald conducted reconnaissance and documented as much damage and geologic features as possible soon after the quake. Adam McKean and Ben Erickson collected data for the clearinghouse and analyzing data. They now have 768 items in the clearinghouse, which has inputs from several groups and private citizens. He invited others to also submit information and that it be sent to benerickson@utah.gov. The clearinghouse data can be accessed at https://geodata.geology.utah.gov.

Adam Hiscock discussed his field team participation. He is a licensed UAV pilot and was able to get unique video and aerial footage from the earthquake. He showed photographs and footage captured from the UAV. He showed their field operation review and the aftershock

sequence. He discussed that the M5.7 earthquake is too small for surface fault rupture; however, there are many liquefaction and lateral spread features. He discussed sand boils and showed photos from the earthquake. He further discussed the Great Salt Lake Marina damage and showed other damage photographs. Kennecott Utah Copper granted permission to enter their property for reconnaissance near the earthquake epicenter. He discussed possible co-seismic rockfall near Ensign Peak and discussed the difficulty of determining if the rockfall was quake related.

Emily Kleber discussed the clearinghouse and specifically how they received the data. She discussed the importance of a having a clearinghouse because it is a compilation of data that other partners inside and outside of Utah can share and review. On March 25-26th, they requested the public send photographs and videos. They shared a Google Form on social media, using Facebook, Instagram, and Twitter for public outreach. Twitter had the most participation and inputs. Overall, this yielded 50 photos and 15 videos from the public. She demonstrated the clearinghouse (https://geodata.geology.utah.gov) and solicited anyone having more information to please submit data. She discussed the interactive map that Gordon Douglass from the UGS created. She expects that people will be learning much more about earthquake geology from visiting this website. She showed the UGS website (https://geology.utah.gov/hazards/) with additional information and interactive tools. They now have a report that shows how they completed the earthquake mapping and a map showing the mapped faults and delineated special study zones. This is an improvement on where faults have been identified and mapped. She showed areas on the maps delineating recommended special study zones and discussed what they mean. She discussed additional tools for the entire WFZ that can be accessed on the webpage. She said at this point, the WFZ is mapped better than any other normal fault in the world. She discussed where to find Quaternary fault maps from their website.

Chris DuRoss asked Adam about his presentation and about a potential geophysical investigation of the Great Salt Lake. He was curious if he saw other failures, rather than just sand boils.

Adam said their observed failures were pretty much what he showed on the presentation. He discussed the Antelope Island reconnaissance and some the findings.

Leon mentioned that he went to White Rock Bay on Antelope Island and observed a few earthquake related features.

Adam said that his colleague found one of the biggest mounds on White Rock Bay. Some of the earthquake features associated with the seeps soon disappeared. He further explained effects of liquefaction and soil collapse.

Bob Carey introduced Sheila Curtis as the Operations Manager for the Utah Division of Emergency Management. He discussed that our EOC was already activated for the COVID-19 pandemic.

Sheila Curtis discussed the EOC's involvement, the occurrence of the earthquake, the activation efforts of the EOC, and her assessment of the situation. DEM increased the EOC activation to Level I from Level II and Level I is the highest-level activation. DEM activated the different emergency service functions (ESF) as needed. She discussed the concerns about evacuating Magna after the earthquake, the Emergency Management Assistance Compact (EMAC), and the "big rumors" of a M9 earthquake. The State of Utah requested that Task Force One be activated and brought in the mitigation and recovery staff and discussed temporary housing,

sheltering 23 individuals in hotels. There were 20 international students that were stuck at the Salt Lake City International Airport. She discussed the EOC completing various missions to address the earthquake.

Bob added that this was the "designer earthquake". He discussed the live Governor's News Conference that was held the morning of the earthquake at the Salt Lake City Public Safety Building with various agencies, including the UGS and UUSS. One of the immediate issues was addressing the rumor of an impending M9 earthquake. Another false report was that the oil refineries in North Salt Lake were on fire and that there was a "run" on gasoline (especially in Utah County). They received a request from UUSS to help place temporary seismometers after the earthquake. He discussed his conversation with Barry Welliver and Magna City. Because the earthquake was centered in Magna, local officials reached out to him. There was confusion about ATC-20 inspection versus a different damage assessment, which goes towards receiving a Presidential Disaster Declaration. Most jurisdictions had some sort of earthquake insurance. The State of Utah requested a 30-day extension for evaluation of earthquake damage from the Federal Emergency Management Agency (FEMA) because of the pandemic. Salt Lake County conducted a damage survey and asked that data it be added to the clearinghouse. There is some work to do on the ATC-20 side. He mentioned that Brad Bartholomew of DEM was not at the meeting because he was busy doing COVID-19 work. Bob mentioned that Brad would have updated damage report and disaster information for the next Commission meeting.

Keith asked if there was one document that summarizes all the damage.

Bob said there was not anything yet, but they are now working to compile the information. He said it would be interesting to examine how the Fix the Bricks program performed. He mentioned there was damage to homes on both sides of particular homes that underwent Fix the Bricks mitigation work. He said it will be very interesting to see the mitigation and how it performed.

Bob said that Patrick Tomasino of the Utah Division of Facilities and Construction Management (DFCM) will also provide a damage report on what the state has completed.

Jessica asked about volunteer inspectors. She there was no request for inspectors within the state.

Bob said that there was a request from Salt Lake City to the State of Utah for the damage side, and not for the building safety evaluation side. He received a call from Barry Welliver, who was in the field. There were some issues of who will get paid and how. The public officials decided to back off asking outside help, and they resolved it in-house—without asking for outside ATC-20 inspectors.

Leon said because of the pandemic many buildings were empty. There were 70 buildings that needed inspection—many of the buildings were closed. Because the buildings were closed, they were not under a strict time requirement for inspections and they were able to use their internal staff to conduct inspections.

Steve Bruemmer said they did a great job explaining the reasons they did not need an ATC-20 response from outside inspectors. He said areas were cleaned up even before Emily's group could conduct inspections. He inquired if there was a process to get out even earlier to document issues—before it is cleaned up.

Emily replied that on the day of the earthquake, they were onsite early and that they avoided any contact with first responders. They did not visit the mobile home park, Magna downtown area,

and that there were red tags on the buildings and they worked to avoid any contact or interruption of first responders.

Bob mentioned that this is an event that would not cause a lot of damage. If it is a "big story," then it will be in the news the next day. He continued that the "next day" was not big news day for the earthquake. He continued that it is very important to look at the damage at once so that damage history is recorded.

Jessica Chappell presented a report from the Structural Engineers Association of Utah. She discussed her personal first-hand experience as a structural engineer. She discussed structures and reviewed earthquake details, noting that there was no loss of life. She further discussed that economic losses were estimated to be under $100 million. She spoke of shaking intensity and showed a map of shaking intensity. Salt Lake City felt strong to moderate shaking intensity. There was a broad range of people who felt the shaking in buildings. She showed a historic structural damage map from the State Historic Preservation Office. Magna City is a mining town and many of the structures are original structures. Salt Lake City also has many original buildings. She discussed structural versus non-structural damage. She also showed examples of non-structural damage and provided examples from the Salt Lake International Airport. There nearly 50 homes that were red tagged and occupants were only allowed to retrieve belongings. She discussed mobile homes and URM damage and supplied examples. She provided examples of damage with X-type cracks showing damage from building shaking and she showed a multi-wide URM that was bulging. There is a lot of discussion about damage to schools. She pointed out that key points to damage to vulnerable building types are URMs and mobile homes. Extensive nonstructural damage from water leaks, falling items, and mechanical elements create significant damage. No volunteer requests were made to ATC-20. Current state public entities have evaluations and repairs underway and private owners no self-reporting requirement to report damage. She referenced buildings being condemned for occupancy.

Bob made a comment about people not being required to report. He said that participation was less because of the COVID-19 pandemic, a lot of people did not want to report because they did not want to be evicted from their home during a pandemic.

Jessica said they have a large amount of URMs. Most of the URM homes are smaller and simpler structures, and they were not damaged as much. She mentioned that the larger URMs posed a larger threat. We currently do not have a mechanism for reporting large URM damage from owners and that maybe some form of legislation is needed.

Patrick Tomasino discussed that he was dispatched to do inspections over the course of a week and half. Most of the facilities he inspected were not occupied because of the pandemic. They looked at, overserved and witnessed column cracking, surface cracking, and other non-structural damage. When they did overserve structural damage, they had a structural engineer come in and review damages. DFCM has also created a report and is tracking repairs. He discussed ATC-20 evaluators. The Incident Command System says all incidents are local and they do their own work. The state was not employed or asked to participate in outside structures or review.

Pete McDonough, Dominion Energy, retired, thanked Met Barthow, Dominion Energy Director of Operations and Seth Bazier, Dominion Energy in Park City, who had provided Pete with

data regarding the earthquake. He mentioned that with natural gas distribution systems, damage begins at about M5 and above. He discussed Reavely Engineer's participation. There were 337 buildings with gas that was turned off. Only 38 of those buildings had actual gas leaks. This is important information to gas companies because they have to go back, and conduct relight procedures after restoring gas service. He discussed other earthquakes and only 22% have gas leaks. He discussed Dominion Energy's outreach to citizens about earthquakes. Dominion Energy reported 49 mobile homes had turned off the gas and there were no fires reported and no leaks on their main system that uses polyethylene (plastic) pipe that reduced failures. Plastic pipe helps reduce earthquake damage and cast-iron systems were retired in the 1980s. Dominion Energy does not have information on seismically activated systems. Of the 391 leaks on company facilities, 97% were on meter sets. These meter sets contain multiple stress points. Three percent were on underground service lines and 4% were at tapped main locations. One was on corroded steel service. Of the 133 leaks on customer property, 33% were on water heaters. Most new water heater installations require the water heaters being strapped. The system held up quite well.

Leon discussed Salt Lake County Public Works perspective. The Emergency Coordination Center (ECC) was activated and Leon spent the first day there. They required everyone be tested for COVID-19 before entering their ECC. They discussed the possible evacuation of Magna City. He showed damage to various buildings, including Colosomos and showed Main Street in Magna with damage. He described setting up barricades and providing protective closures to traffic. He showed several URMs and damages. They met in the Webster Building and worked with Trent Sorensen, Building Official and Crystal Cobert, the leads for organizing inspections. Leon assisted them as much as he could. They had over 70 county buildings that they provided rapid visual assessments. They placard the buildings green, yellow and red. He discussed the new Magna City Library and the limited damage. The library had a gas leak on the library. They discovered water leaks in some of the other county buildings. He discussed finding some gas leaks and Dominion Energy's quick response to conducting repairs. He discussed social media rumors and their efforts to fix misinformation. He said the Utah news media did an excellent job correcting misinformation. He repeated that it was fortunate that most of the buildings were not occupied and they did not feel pressure to reopen quickly.

Jessica discussed the Wasatch Front URM Risk Reduction Strategy. It is a pilot program put together by FEMA. She discussed the project membership and the collaborative effort from various groups. National Mitigation Investment strategy is an effort to reduce risk where the entire community sees the benefit. She discussed the URM Conference from the Utah Division of Emergency management and FEMA. There is a national exercise for 2021 and that this is a great opportunity to test the resources we have in place. The main goal is to review the risk. The final draft will be completed in late September and published in the 2021 national exercise. She discussed previous publications on URM risk and mitigation programs. The team is taking these documents, engaging stake holders, and the idea is pulling in local participants who are invested in this and creating something that is right for our community. She mentioned to go the Commission website for the documents. She discussed the introduction and background the key considerations and strategy recommendations. All of the

different items are intended to look at funding suggestions. Each of the suggestions will have correlating funding solutions.

Keith Koper discussed earthquakes in the western United States. A couple of weeks after the March 18th event, there was an M6.5 earthquake with 700 aftershocks in Idaho. This earthquake happened soon after the Magna event and people had a lot of questions. There is no obvious relationship between the two events, and it is unlikely there were any relationships. It was west of Chalis, Idaho in a remote area. It was a strike-slip earthquake with sideways motion and felt in Utah. He discussed another event near Reno, Nevada that was earlier than our Magna sequence with no relationship to the Magna earthquake.

Brent Maxfield introduced himself as concerned citizen as part of a group that refers to themselves as the Utah Citizens for Seismic Safety, who is formed of two structural engineers, three geologists, and one urban planner. Barry Welliver and Brent Maxfield are the structural engineers; Jack Bloom, Grant Willis, and John Hermance are the geologists; and the urban Planner is Divya Chandrasekhar.

Divya Chandrasekhar thanked Brent for the introduction. She is a professor at the University of Utah and her specialty is post-disaster recovery and reconstruction. They commonly agree to discuss earthquake safety and have three goals: to provide a consistent message, mobilize support, and push for legislative action. They are here to complement and enhance the activities of the Commission. They are asking for input on a messaging statement and seek to help promote and disseminate the message. They wish to use a multi-disciplinary approach to document earthquake safety concerns from various angles using multiple institutional connections that include the private and public sectors, higher education, nonprofit organizations, religious institutions, and technical organizations. She said the same message should be communicated to mobile homeowners as well as everyone else and the message is a one-page document. There is an earthquake problem, the threat is real, the impact will be big, there is a need for action and we have a URM problem. There is a need for action and action needs to be taken now. They would like the Commission's support and input on finalizing this document. That message, once finalized will be presented at the next Commission meeting.

Joaquin Mixco and Becky Nix presented on the Utah Department of Transportation's (UDOT) response to the earthquake response.

Joaquin explained his role as Emergency Manager for UDOT and turned the time to Becky.

Becky described her role working with the emergency response plan and her role in the bridge inspection during the earthquake. She discussed the UDOT Bridge Management Manual, emergency response plan, training, and the ShakeCast models. On the morning of the event, the maintenance staff mobilized at once and activated a second level of inspection. They had 12 teams out that morning and everyone was on-site within an hour of the event. The inspection teams reviewed the major routes first. They utilized two coordination individuals to help avoid overlap of work. She ran the reporting coordination and they maintained real-time reporting. They identified one bridge that they closed immediately. They have four levels they rate the bridges: Red (closed), Orange (limited use), Yellow (damage, but not structural problems), and Green (normal use). They used stickers for each of the bridges they inspected that included the date and time of inspection. The second thing they did was they used tape for

inspections. As soon as you drove up to the bridge, you could quickly identify the inspection. Another tool they utilized was using Google Maps and each team had real-time monitoring, so you could see if it were red, orange, yellow or green. They examined 710 bridges over two and half days. Anytime there was M3 or higher earthquake, they re-inspected the bridges with their maintenance staff. A M4.5 or higher earthquake required structural staff return for an entire new inspection. Now they are in recovery phase and prioritizing which structures need repairs. They had eight bridges that needed repairs after the event and one bridge that was closed, using in-house crews to repair the closed bridge. They have an established contractor pool, so that they were able to conduct a faster repair schedule. They are now conducting reviews on what worked well and what did not. She discussed rain during the event caused problems with the stickers being affixed and they are reviewing alternatives. They are also reviewing a mobile app to be placed on phones so they can put their inputs directly into their phones and upload data later if data is not available. She discussed the UDOT website and the bridge manual is accessible online.

Leon thanked the presenters and suggested the next meeting be on July 30, 2020. Everyone agreed to have the meeting on Thursday, July 30 from 9:00 a.m. to noon.

Pete asked if there were any water main breaks.
Leon clarified that there were no watermain breaks
Bob reminded the Commission that the next meeting would be an election meeting.

The meeting was ended by acclamation.