



State Of California

ALFRED E. ALQUIST SEISMIC SAFETY COMMISSION



Governor Edmund G. Brown Jr.

Revised AGENDA
June 11, 2015
State Capitol, Room 437
Sacramento CA 95814

Time	Item	AGENDA	Action
10:00	I.	Call to Order Roll Call	Roll Call
10:05	II.	Chairman's Remarks <i>Commissioner Timothy Strack</i>	Discussion & Possible Action
10:10	III.	Approval of April 9, 2015 Meeting Minutes	Discussion & Possible Action
10:15	IV.	The Nepal Earthquake: Lessons for California <i>Mr. Frank Webb, Deputy Manager Earth Science Research & Formation Office, Jet Propulsion Laboratory</i> <i>Commissioner Kit Miyamoto, Seismic Safety Commission</i> <i>Urban Search & Rescue, Task Force 2, Invited</i>	Discussion & Possible Action
10:45	V.	Simulation-Based Tools for Understanding and Enhancing the Process of Post-Earthquake Recovery <i>Mr. Henry Burton, University of California at Los Angeles, Global Earthquake Model</i>	Discussion & Possible Action
11:10	VI.	Uniform California Earthquake Rupture Forecast <i>Commissioner Dr. Gregory Beroza</i>	Discussion & Possible Action
11:30	VII.	Office of Statewide Health, Planning & Development Annual Report <i>Mr. Chris Tokas, Deputy Division Chief</i>	Discussion & Possible Action
11:50	VIII.	Guide to Identify and Manage Seismic Risks of Buildings for Local Governments <i>Commissioner Randy Goodwin,</i> <i>Mr. Fred Turner, Staff Services Structural Engineer, Seismic Safety Commission</i>	Discussion & Possible Action
12:00	IX.	Legislative Update <i>Ms. Salina Valencia, Legislative Director, Seismic Safety Commission</i>	Discussion & Possible Action
12:15	X.	Executive Director's Report <ul style="list-style-type: none"> • Budget • Filling Vacant SSM I Position • Renew Commission Webpage Contract • California State Fair: Earthquake Exhibit <i>Mr. Richard McCarthy, Executive Director, Seismic Safety Commission</i>	Discussion & Possible Action
12:30	XI.	Public Comment <i>(Please complete a "Request to Speak" Form)</i>	Discussion & Possible Action
12:35	XII.	Miscellaneous & Good of the Meeting	Discussion & Possible Action
12:40	XII.	Adjourn	Discussion & Possible Action

Next Meeting: August 13, 2015

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MEETING NOTICES

SIGN-UP & TIME LIMITS: If you wish to speak on an item, please fill out a “Request to Speak” form and give it to a staff person before the public hearing. The forms are available near the door to the meeting room. Time limits are indicated on the speaker sign-up forms and in case of questions or disputes the Chairman will determine the time limits for each speaker at the beginning of the public hearing.

SUGGESTIONS FOR SUBMISSION OF WRITTEN MATERIALS. It is requested that written materials be submitted to the Commission staff prior to the meeting. If this is not possible it is requested that at least 30 copies be submitted to the Commission. This material will be distributed to the Commission members. Applicants are responsible for presenting their projects at the public hearing. **NO FAXES** will be accepted at the meeting site. You may be able to make prior arrangements with staff or a Commissioner to send a fax but you will be responsible for paying the hotel or meeting site for its receipt.

CLOSED SESSION: The Commission may meet to consider possible and pending litigation in a session closed to the public pursuant to attorney-client privilege and statutory exception to the Open Meeting Act (Government Code §11126e).

ACCESS TO HEARING: Meeting facilities are accessible to persons with disabilities. If you require special assistance, please contact any staff member prior to the meeting. An interpreter for the deaf will also be made available upon request to the staff at least five days prior to the meeting.



State Of California

ALFRED E. ALQUIST SEISMIC SAFETY COMMISSION



Governor Edmund G. Brown Jr.

Board of Supervisors Hearing Room
105 East Anapamu Street, 4th Floor
Santa Barbara, California
Minutes of Regular Meeting
April 9, 2015

Members Present

Timothy Strack, Chairman
Tracy Johnson, Vice Chair
Salud Carbajal
Michael Gardner
Mark Ghilarducci
Randall Goodwin
Peggy Hellweg
Helen Knudson
Jim McGowan
Ian Parkinson
Fuad Sweiss
Mark Wheatley

Members Absent

Greg Beroza
Ken Cooley
Kit Miyamoto
David Rabbitt
Chet Widom

Staff Present

Richard McCarthy, Executive Director
Fred Turner, Structural Engineer
Salina Valencia, Legislative Director

I. CALL TO ORDER AND ROLL CALL

Commission Chairman Timothy Strack called the meeting to order at 10:05 a.m. and welcomed all participants.

II. CHAIRMAN'S REMARKS

Chairman Strack thanked Supervisor Janet Wolf and the Santa Barbara County Board of Supervisors for allowing the Commission to use its meeting space. He said the Commission was pleased and honored to be in Santa Barbara, one of California's most beautiful and diverse areas.

Chairman Strack said that on April 8, the Commission presented the Board of Supervisors with information on the Commission's background and history, and had an opportunity to hear from the Board of Supervisors and discuss ways of working together to improve the seismic safety of Santa Barbara and the state.

Chairman Strack proposed deferring Item III, approval of minutes, until later in the meeting.

Legislative Director Salina Valencia called the roll and confirmed the presence of a quorum.

IV. OPENING COMMENTS

Chairman Strack invited Commissioner Salud Carbajal to introduce the presentations from Santa Barbara County.

Commissioner Carbajal expressed his appreciation to the Commission for visiting Santa Barbara, an area that has experienced many natural disasters. He introduced the chair of the Santa Barbara County Board of Supervisors, Janet Wolf, to give an official welcome.

V. COUNTY BOARD OF SUPERVISORS

Honorable Janet Wolf, Chair, Santa Barbara County Board of Supervisors, said the Board of Supervisors enjoyed meeting the Commission and staff at the April 8 Board of Supervisors meeting. She said the Board of Supervisors has been grappling with budget issues recently, so it was refreshing to focus on earthquake vulnerability. She thanked Chairman Strack and Executive Director Richard McCarthy for meeting in Santa Barbara.

Supervisor Wolf said people in Santa Barbara County feel lucky to live in this beautiful, varied, and diverse community. She observed that Santa Barbara County has also had its share of disasters, including four major fires during her tenure on the Board of Supervisors. She noted that the area has not had a major earthquake recently, but residents are aware of the seismic risk. Supervisor Wolf added that she attended high school with Lucy Jones, a well-known advocate for earthquake preparedness.

Supervisor Wolf said the Commission would be hearing later from Ryan Rockabrand, director of Santa Barbara's emergency operations center. She indicated that Santa Barbara has a new operations center, a project born out of the local fire disasters, but also because people are aware of their vulnerabilities to floods and earthquakes. She stated that the emergency operations center is well staffed and ready to respond to any kind of emergency.

Supervisor Wolf advised that the people in northern Santa Barbara County are concerned about their proximity to the Diablo Canyon nuclear power plant. She pointed out that Highway 101 is the main access route in and out of the county, north or south, with mountains on one side and the ocean on the other, so people are concerned about preparedness.

Supervisor Wolf said the Board of Supervisors, because of the leadership of Supervisor Carbajal, directed the staff to look at the vulnerability of the building stock in Santa Barbara County, and she cited this as a great leap forward. She said the county will continue to work on preparedness and communicating with constituents. She expressed her appreciation to the Commission for the policy initiatives it promotes and disseminates. She added that she hoped Santa Barbara would be considered as a site for a pilot project to test the statewide early warning system.

Supervisor Wolf wished the Commission an enjoyable stay and expressed her appreciation to the Commission for its work and to Supervisor Carbajal for arranging this meeting.

Commissioner Mark Ghilarducci said that before he was appointed as Governor Brown's emergency manager and homeland security chief, he spent considerable time in Santa Barbara working with the Board of Supervisors. He commented that Santa Barbara has improved tremendously from where it was a few years ago, in terms of both its preparedness level and capacity, and he recalled that the emergency operations center was working out of portable trailers then. Commissioner Ghilarducci recalled concerns voiced by members of the public after the fires about disaster preparedness. He commended the Santa Barbara County Board of Supervisors for making Santa Barbara County one of leaders in public safety now. He said Santa Barbara is being used as a model throughout the nation. Commissioner Ghilarducci congratulated Santa Barbara County for its state of preparedness.

Supervisor Wolf said the accomplishments were a team effort, and she expressed her appreciation to the Board of Supervisors, the staff, and the members of the community for their support and help.

Supervisor Carbajal remarked that Supervisor Wolf was the linchpin on the Board of Supervisors and remained steadfast in her leadership on this issue.

VI. CITY OF SANTA BARBARA

Chairman Strack introduced Mayor Helene Schneider and invited her to address the Commission.

Mayor Schneider welcomed the Commission to Santa Barbara and said she hoped commissioners enjoy their stay.

Mayor Schneider observed that disasters follow no jurisdictional lines, so disaster preparedness and response is a joint effort of the Santa Barbara County Board of Supervisors and staff, the City Council and staff, and other community areas who work together to provide emergency aid. She noted that Santa Barbara upgraded its emergency operations center to its main fire station a few years ago, and more recently moved the dispatch center from a seismically vulnerable 1960's building to the Granada garage facility, a safer facility.

Mayor Schneider reviewed some of the major earthquakes Santa Barbara experienced in the past. She said the first was in December of 1812, an event ranking 10 on a scale of 1 to 12, with 12 representing total destruction of a community; a 6.3-magnitude earthquake occurred 113 years later, in June of 1925, causing 13 deaths and \$6 million in damages. She noted that the reconstruction effort after this event led to the establishment of the City of Santa Barbara's Architectural Board of Review and adoption of the prevalent Spanish Revival style of architecture.

Mayor Schneider stated that Santa Barbara experienced a magnitude 5.9 earthquake in August of 1978, causing \$7.3 million in damage, but no deaths, reflecting improvements in seismic safety policies and procedures.

Mayor Schneider observed that 37 years later, in Santa Barbara over 200 unreinforced masonry buildings have been evaluated and seismically retrofitted. She expressed her appreciation to the Seismic Safety Commission for the policy guidance it provides to cities and counties to help them deal with these issues. Mayor Schneider said Santa Barbara is working with other cities to address soft-story buildings to minimize loss of life and injuries in the event of an earthquake.

Mayor Schneider expressed her appreciation for the Commission's work with cities and counties to provide information and sound policy direction focusing on seismic resilience. She welcomed assistance from the state in finding the financial resources needed to move these efforts forward.

Mayor Schneider thanked Commissioner Carbajal for his assistance and leadership.

Chairman Strack noted that at the Board of Supervisors meeting the previous day, he explained that the Commission wants to meet away from Sacramento to hear from local government officials and citizens, and he welcomed this outreach opportunity.

VII. SENATE REPRESENTATIVE

Ms. Fran Farina, District Representative for Senator Hannah-Beth Jackson, joined in welcoming the Commission to Santa Barbara. She encouraged commissioners to take advantage of the area's beauty and attractions during their visit. She advised that because of the drought, local restaurants serve drinking water only upon request.

Ms. Farina explained that Senator Jackson was in a legislative session in Sacramento and regretted that she was unable to attend in person. She noted that Senator Jackson just returned from a trip to Japan, and one of the issues she explored there was local earthquake preparedness, and she had a few remarks to share with the Commission.

Ms. Farina indicated that Senator Jackson reported that when the Japanese government evaluates earthquake preparedness and recovery, the recovery focuses on basic public infrastructure, such as roads; electric, gas, and water utilities; and food. She observed that people tend to focus so much on preparedness that they overlook recovery. Ms. Farina said Senator Jackson plans to encourage Assembly Member Rodriguez, the current chair of the Joint Legislative Management Committee on Emergency Management, to hold a hearing on earthquake preparedness and recovery.

Ms. Farina mentioned that Senator Jackson's district includes all of Santa Barbara County as well as the western portion of Ventura County. She introduced Mr. Kevin McGowan, from the Ventura-based Office of Emergency Services, and asked him to talk in more detail about that agency's earthquake preparedness activities.

Ms. Farina indicated that the Office of Emergency Services had launched a public outreach effort called "Ready Ventura County" to develop a three-day individual preparedness capability. She said they have a redesigned and improved countywide POST incident command assessment and building assessment program, recently revised after the Camarillo Springs disaster, which began with a fire during the summer, followed by mudslides produced by the first rains in October, and

then a heavy storm in December that resulted in severe damage to homes from rock slides. She observe that the region has since improved its damage assessment and building safety program. Ms. Farina reported that the Office of Emergency Services is working in collaboration with the California Integrated Seismic Network and Santa Barbara County on the early earthquake warning system.

Chairman Strack thanked Ms. Farina for her remarks.

VIII. ASSEMBLY REPRESENTATIVE

Chairman Strack welcomed Ms. Hillary Blackerby, Senior Field Representative, Office of Assemblymember Das Williams.

Ms. Blackerby said Assemblymember Williams represents southern Santa Barbara County and western Ventura County, and is a member of the Select Committee for Local Emergency Preparedness. She added that he was unable to attend this meeting because he was attending a hearing on 911 location accuracy.

Ms. Blackerby noted that the Office of Emergency Management has done a great job of upgrading, and people in the community have stepped up their own preparedness efforts. She reported that the area has an award-winning CERT program, with many volunteers ready to act in emergencies. She added that people on the Central Coast are making great progress in preparedness and resiliency. She thanked the Commission for its work and offered Assemblymember Williams' support.

Chairman Strack thanked Ms. Blackerby for her comments.

IX. REPORT ON EARTHQUAKE VULNERABILITY OF BUILDINGS IN SANTA BARBARA COUNTY

Commissioner Carbajal introduced a series of presentations from Santa Barbara County's Planning and Development Department, starting with a report on vulnerabilities the County has analyzed and the direction the Board of Supervisors provided in terms of follow-up actions on these issues.

Dr. Glenn Russell, Director, Planning and Development Department, said Building Official and Deputy Director of Building and Safety, Massoud Abolhoda, formerly worked for the City of Fremont and was responsible for some of the early earthquake-related ordinances addressing issues such as soft stories. He invited Mr. Abolhoda to address the Commission.

Mr. Abolhoda said the report identifies all types of potentially hazardous buildings during an earthquake. He presented an earthquake hazard map of California and noted the areas of peak ground acceleration and shaking. He pointed out that most of southern Santa Barbara County is shown in red, indicating the possibility of a very strong earthquake occurring there. Mr. Abolhoda advised that geologists and seismologists believe an earthquake of a 7.0 moment magnitude can occur in Santa Barbara if several faults rupture simultaneously. He observed that this would cause hundreds of millions of dollars in damages as well as loss of lives.

Mr. Abolhoda noted that the report presented to the Board of Supervisors identifies the most vulnerable building types that may exist in the County of Santa Barbara, discusses actions by other jurisdictions, and recommends next steps. He said the report did not address slope stability, liquefaction, and other geohazards related to an earthquake, post-earthquake fire hazards, tsunamis, public buildings, oil and gas utilities, and infrastructure.

Mr. Abolhoda stated that soft-story buildings have received considerable media attention in recent years, and he showed a slide of a soft-story building in San Francisco that was damaged in the 1989 Loma Prieta earthquake. He explained that walls in these buildings are the primary source of resisting earthquake loads, and a major reduction of the walls due to garage entry doors or a storefront results in having substantially less stiffness and strength at the lower level, causing failure at the so-called soft levels. Mr. Abolhoda advised that the County had not observed many of these buildings in the Santa Barbara area.

Mr. Abolhoda noted that retrofit costs can vary from \$4 to \$10 per square foot, based on a report by the City of San Francisco, which is substantially less than the typical \$20 per square foot repair costs, not including loss of income. He pointed out that other benefits of retrofitting would be their life-saving potential and increasing the value and lifespan of the building.

Mr. Abolhoda displayed a schematic diagram of a typical soft-story retrofit, consisting of installing a new steel frame and foundation within one of the garage openings. He said the number and size of the frame depends on the height, weight, and size of the building. He showed a slide of a soft-story building that collapsed during the Northridge earthquake, resulting in loss of life as well as loss of the building.

Mr. Abolhoda showed an example of a tilt-up concrete building that collapsed in the 2010 Chilean earthquake. He said pre-1973 buildings, those designed to earlier versions of the Uniform Building Code, with concrete and masonry walls and wood or metal roof and floor are vulnerable to earthquake damage. He explained that the main weakness of this type of building is in the connection of the walls to the roof and floor, because the connections tend to separate during an earthquake, resulting in partial or complete collapse of the building. Mr. Abolhoda presented slides depicting examples of damaged buildings. He added that this type of construction is typically found in commercial and industrial areas, and there are only a few of them in the County of Santa Barbara.

Mr. Abolhoda advised that seismic retrofit of this type of building is relatively simple, with an average cost of about \$5 per square foot. He showed slides of typical retrofits.

Mr. Abolhoda said many pre-1950 single-family homes lack proper bracing walls in the crawl space or have no connection between the sill plate and foundation. He noted that this puts the building at risk of falling off the foundation during a medium to strong earthquake. He showed examples of damage from this kind of failure. Mr. Abolhoda stated a retrofit of these homes entails adding bracing and anchors to the foundation, and the retrofit is relatively simple when there is sufficient headroom in the crawl space. He displayed slides showing crawl spaces with

no bracing, and then a retrofitted crawl space with plywood paneling reinforcement and anchoring sill plates to the foundation.

Mr. Abolhoda observed that chimneys in many houses constructed pre-1950, and even later, were constructed from unreinforced masonry, so they can break and fall in an earthquake, causing damage and injuries to occupants of the house and adjacent properties. He remarked that there are many instances of unreinforced masonry chimneys in the County of Santa Barbara. He showed an example of retrofitting with steel bracing connecting the chimney to the roof, but noted the best solution is to replace the chimney with wood framing and a metal flue. He added that applying plywood paneling above the ceiling around the chimney flue prevents the chimney from falling inside the house, but it does not prevent the chimney from falling outward.

Mr. Abolhoda discussed damage to mobile homes after earthquakes. He showed a picture of a mobile home failure after the recent Napa earthquake. He noted that pre-1994 mobile homes were often supported on metal pedestals that were not designed to resist earthquake forces, so if they fall off their pedestals during an earthquake, they can rupture gas lines, starting fires.

Mr. Abolhoda reported that Santa Barbara County has about 2,729 mobile home spaces. He said mobile home construction is regulated by the State of California Housing and Community Development, and only that agency can require a retrofit.

Mr. Abolhoda showed a picture of the Kaiser Permanente medical building in Granada Hills, an older, nonductile reinforced concrete frame construction, and a wall collapsed and separated from the main unit over the full height of the building. He explained that concrete buildings constructed to 1976 or later versions of the building codes are considered ductile and have reinforcement systems that enable the structure to plastically deform and absorb energy without failure; concrete buildings constructed to older codes are considered nonductile and will have only a limited energy absorption, resulting in sudden loss of strength and the possibility of collapse under high seismic loads. He advised that the County does not expect to find many nonductile concrete buildings within its jurisdiction. Mr. Abolhoda observed that some hospitals, schools, and government buildings in other parts of the state have been retrofitted, and retrofit methods vary drastically and are usually very costly.

Mr. Abolhoda noted that the Northridge earthquake revealed a major problem with modern steel buildings: many welded connections of beams to columns can fracture or fail, resulting in a partial or total collapse of the building during an earthquake with long duration or in a subsequent aftershock. He displayed a picture showing cracks through a moment connection. He said these connections are most hazardous in mid-rise and high-rise buildings, of which there are only a few in Santa Barbara County. He indicated that these types of frames were used occasionally in residential buildings, but they are not considered a significant risk due to the light weight of the wood frame houses. He noted that retrofit methods vary and can be expensive.

Mr. Abolhoda showed examples of damage to unreinforced masonry (URM) buildings. He said the State of California mandated that all jurisdictions compile an inventory of their URM's, and Santa Barbara identified its building and passed a mandatory retrofit ordinance for privately-

owned buildings in 1994. He stated that according to the Seismic Safety Commission's report, all URM buildings in the County have been retrofitted or demolished.

Mr. Abolhoda talked about what some neighboring cities are doing. He said the County of Ventura, County of San Luis Obispo, Cities of Santa Barbara, Ventura, and Solvang have mandatory retrofit programs, and the staff has not been able to verify whether the City of Goleta also has one. He reported that the City of Lompoc only requires URM's to be posted with placards identifying the building as an earthquake hazard; the Cities of Fremont, Berkeley, and San Francisco have adopted mandatory retrofit ordinances for soft-story buildings; and the Cities of Los Angeles and Fremont have mandatory retrofit ordinances for tilt-up buildings. Mr. Abolhoda said he was unable to verify if any other city has a mandated program for tilt-ups.

Mr. Abolhoda noted that the County's next steps are to develop a voluntary retrofit and educational program for single-family homes, develop options for future consideration of a mandatory retrofit when substantial modifications or additions are proposed, and prepare a code amendment to address construction on a steep hillside, similar to the City of Los Angeles. He said for nonresidential and multi-family residential buildings, the County will conduct a survey to identify at-risk buildings, provide owner outreach and education on the earthquake vulnerability of their buildings, and develop options for future consideration of retrofit.

Commissioner Carbajal said that when he and other County officials became aware of some of the vulnerabilities, they directed the staff to conduct a more detailed analysis and follow-up action plan. He emphasized the need to encourage local governments to give seismic safety a higher priority, and he commended the his fellow supervisors and the County staff for their efforts.

Mr. Abolhoda responded that a countywide survey has not yet been conducted, but that task is on the action plan. He said the County did survey Isla Vista, the most populated part the County in terms of apartment buildings, but no soft-story buildings were found, although there may be some within the City of Santa Barbara. He remarked that Santa Barbara County does not have as many areas with apartment complexes as more metropolitan areas.

Mr. Abolhoda stated that a survey of Westmont College is also part of the action plan, and there may be a few buildings of concern there.

Commissioner Carbajal noted that the County survey only covers unincorporated County areas, not the City of Santa Barbara and other cities. He expressed his hope that the County's efforts will be a catalyst for cities to undertake similar efforts.

Chairman Strack thanked the Santa Barbara County representatives for their presentations, and he commended Commissioner Carbajal and the staff from Santa Barbara County for their great work.

X. EARTHQUAKE EARLY WARNING AND SANTA BARBARA COUNTY

Commissioner Carbajal introduced Mr. Ryan Rockabrand, Director, Santa Barbara County Office of Emergency Management, and asked him to describe Santa Barbara County's involvement in the earthquake early warning system.

Mr. Rockabrand thanked the Commission for the opportunity to discuss this important project. He said Santa Barbara County was fortunate to be able to leverage some existing funding to implement the earthquake early warning system. He noted that earthquakes are third on the list of Santa Barbara County's natural hazards, after floods and fires. He acknowledged there was a very significant risk and a high probability, so they are still a major concern locally.

Mr. Rockabrand noted that Mayor Schneider talked about some of the major earthquakes in Santa Barbara's history, and he said both the 1857 San Andreas-Fort Tejon earthquake and the 1925 earthquake had major effects on the area. He showed pictures of damage in 1925, in 1927 after an earthquake in Lompoc and a local tsunami, and a Goleta earthquake in 1978 which caused considerable damage to buildings at the university and the airport, as well as a train derailment. He expressed concern about the risk posed by trains carrying cargos of hazardous materials.

Mr. Rockabrand said Santa Barbara hopes to create an earthquake early warning system that will become a template that other areas can leverage in the future. He noted that Santa Barbara took a whole community approach, developed partnerships with local organizations, and implemented automation. Because of the importance of the governance structure, he observed, having the right team to provide leadership was a key priority, so a task force was assembled to tackle each of the necessary tasks. Mr. Rockabrand acknowledged the support of the Board of Supervisors, Doug Given and Dr. Jones at USGS, former Fire Chief Dyer, and Dr. Glenn Russell and his team.

Mr. Rockabrand stated that the process began with finding a funding mechanism, obtaining authorization to move forward, and then bringing in people with varied expertise, along with their own staff resources, to implement the plan. He indicated that the timeline was extremely aggressive because of funding performance requirements, so the County took a four-phased approach to developing concept and design, implementation, which entails permitting and completion, beta-testing of the system and integrating it with existing networks, and working with partners to leverage use of the system.

Mr. Rockabrand displayed a slide showing the strategic location of vaults along fault lines and photos of vaults. He said units are solar powered, and the sensor unit extends 10 or 15 feet down, with the seismic technology at the base. He noted the GPS is fed by cellular phone, and also to landline facilities, so there is real-time integration. He explained that the vaults feed data to centers at Cal Tech and USGS to calibrate the readings.

Mr. Rockabrand said one of the key milestones was completing site surveys and picking the right spot for quick installations. He thanked the Board of Supervisors and the City Council for allowing the permits and approvals to move forward. He said other milestones were completion

of the licensing agreements, permits, hiring contractors for the digging and installs, all on a very aggressive timeline, and then moving into beta and test launch. Mr. Rockabrand reported that the County held a ribbon-cutting ceremony and a press conference to announce the completion. He added that public outreach and information was a vital component leading to the success of the project.

Mr. Rockabrand said the project's short-term goals were to complete construction and launch the system, and the long-term goal is sustainability. He stressed the importance of having performance measurements, good implementation plans, and working with partners through the whole community approach. He reported that all short-term outcomes were achieved, and a public awareness campaign increased registrations, but the Napa earthquake provided a real-world measurement of the system's performance. Mr. Rockabrand advised that the system provided a 112-second warning to the Santa Barbara area, and although no shaking was felt, there was a notification.

Mr. Rockabrand indicated that the early earthquake warning system is in Phase Four, which involves working with oil and gas industry partners to educate them about how early warnings would benefit them, automating the doors on fire stations so they open before the S-wave hits them, and working with the Office of Emergency Management to send alerts and messages through mobile phones.

Mr. Rockabrand said Santa Barbara has a population of roughly 435,000, but the area gets more than six million visitors a year and more than thirty cruise ships, so informing guests about earthquake preparedness and response is another top priority.

Mr. Rockabrand talked about private-sector partnerships and support for the system. He said the County wants to implement the backbone and support the overall network so it is reliable and robust, but the success of the system depends on its adoption by the private sector. He noted warnings would be useful to factories and construction sites so they can receive notifications and stop certain manufacturing procedures and heavy equipment; as well as to trains and port facilities, operators of oil and gas pipelines, data centers, hospitals, and airports. Mr. Rockabrand emphasized the importance of preventing panic by providing people with information about impending events and what to do. He observed that early warnings would help students in schools, people at large sports facilities, and post-disaster rescue workers so they can brace for the impacts and strong aftershocks. He added that because of the local tsunami risk, Santa Barbara County also needs to warn people to seek high ground and move away from the coastline.

Mr. Rockabrand played a brief video about earthquake and tsunami hazards. He said emergency managers know there are two issues that tend to attract public attention: a real-world disaster, or cinema. He remarked that a crisis sometimes provides an opportunity for people to focus on preparedness. He advised that messaging will be developed within six weeks, and the messages will air throughout the summer. He noted that the goal of the messages will be to encourage people to think about maintaining adequate emergency supplies so they can sustain themselves after disasters.

Mr. Rockabrand stated that the early earthquake warning system is a key element in improving a local jurisdiction's resilience to natural disasters. He said the system will save lives, lessen property damage, and facilitate economic recovery. He observed that the area is still in recovery mode from the 1994 Northridge earthquake, and a joint field office is still staffed and open in Pasadena, and that was not even a significant earthquake. Mr. Rockabrand stressed that the panic and chaos after an earthquake can be reduced by giving people a warning so they can take security measures. He pointed out that the economic impact of a large earthquake can be devastating to local and national economies, and he cited the earthquake in Christchurch, New Zealand, which caused a 6 to 7 percent drop in gross domestic product overnight.

Mr. Rockabrand commented that the message video released this summer will encourage people to focus on their own preparedness, response, and recovery.

Commissioner Ghilarducci asked what kind of permitting and regulatory challenges the County encountered after past disasters. Mr. Rockabrand responded that Santa Barbara was able to leverage many County-owned facilities through local fire stations by bolting on additions to existing stations, and this work was exempted from the California Environmental Quality Act process. He mentioned that the County wanted to install a station in the Santa Inez Valley on a facility with a solar array that was regulated by the Federal Aviation Administration, and that permitting process was too cumbersome and lengthy, so the County found a different source of power.

Commissioner Mark Wheatley asked about public outreach to students at the University Of California (US) at Santa Barbara in terms of tsunami preparedness for that campus location. Mr. Rockabrand said the County works closely with officials at UC and Goleta to be "tsunami-ready" and "storm-ready" certified through the National Oceanic and Atmospheric Agency (NOAA). Commissioner Wheatley said Humboldt State University just completed a tsunami drill with NOAA, and the area has an early warning system and active preparedness efforts on that campus. He thanked the presenters from Santa Barbara County.

Chairman Strack thanked all the speakers and expressed his appreciation to Commissioner Carbajal for his assistance.

Chairman Strack proposed taking the update on the state earthquake early warning system next.

XII. UPDATE ON STATE EARTHQUAKE EARLY WARNING SYSTEM (Out of Order)

Commissioner Ghilarducci congratulated Mr. Rockabrand and Santa Barbara County for their success, and he said Santa Barbara serves as a model for all 58 counties with respect to earthquake early warning.

Commissioner Ghilarducci noted that developing an earthquake early warning system is challenging from a reliability standpoint and a public policy standpoint. He said the statewide effort began with Senate Bill 135 (Padilla) last year, which called for implementation of a

statewide earthquake early warning program. Prior to SB 135, he observed, the earthquake early warning systems were generally developed separately.

Commissioner Ghilarducci described the California Integrated Seismic Network (CISN), developed over twenty years by a loosely aligned group of people from universities, USGS, the Office of Emergency Services (OES), and California Geologic Survey, that applied technology to monitor and record strong motions to identify earthquakes and determine their strength, depth, and complexity. He commented that although this data was very helpful to emergency managers and responders, it was still provided after the fact. He said the challenge will be to turn that capability through new technology into sensing before an earthquake happens, or when the “P” wave arrives.

Commissioner Ghilarducci advised that early warning alerts are highly dependent upon the number of sensor arrays and the user’s location relative to the fault and epicenter of the earthquake. He explained that people close to the epicenter get less warning time, while those who are farther away get more time. He added that the timing also depends on the types of sensors in the ground and the networks over which the signals travel.

Commissioner Ghilarducci reported that since SB 135, OES has engaged with the scientific community, including USGS, CalTech, UC Berkeley, and many others from the state and local government and the private sector, to develop a strategy for identifying the gaps in existing technology and then plan a way to get there.

Commissioner Ghilarducci indicated that this effort produced a number of important results, including an understanding that many of the sensors in the ground today tend to be located around population centers and university; many are older technology that are not sufficiently accurate and reliable, giving some false positive readings; and there are still gaps throughout the state where sensors need to be placed. He advised that there are certain “blind zones” where the system cannot provide accurate announcements of earthquakes, either due to lack of sensors or particular environmental or regulatory obstacles.

Commissioner Ghilarducci commended Santa Barbara County for building an earthquake early warning capability in place. He advised that Long Beach has a similar pilot project, and scientists from Berkeley are working with BART to slow or stop trains during earthquakes. He noted the state has identified 18 critical infrastructure sectors in California, ranging from manufacturing to public health to water systems and dams. He observed that all sectors can benefit from and have a direct interest in the outcome of an effective, reliable earthquake early warning system.

Commissioner Ghilarducci noted that in order to obtain buy-in from local governments and the private sector, they need to know that they can program critical equipment to shut down automatically when certain notifications are received. He emphasized that the goal of the technology is to provide reliable alerts that will save money, mitigate their risk, and save employees’ lives. He said the industry agrees that the system needs to be reliable, so false positives must be eliminated.

Commissioner Ghilarducci commented that the last phase of the project is getting public buy-in and support, and getting the private-sector business community to embrace and incorporate the system within their own operations. He said the goal of scientists at USGS and other organizations is to develop the scientific capability and install the equipment. He added that his responsibility is to bring the two sectors together.

Commissioner Ghilarducci noted that in a state of 38 million people, the earthquake early warning system needs to be reliable and supported by the public. He estimated that the state is currently about 1200 to 1400 sensors short of having a reliable system in California. He acknowledged that having pockets of capability was a great start, but it was not a complete statewide system. He confirmed that there is already technology that works, but the project needs to be rolled out carefully to ensure optimal reliability and complete coverage.

Commissioner Ghilarducci said the earthquake early warning program will need to find a permanent governance system. He noted that California has a number of decentralized organizations throughout the state working to improve seismic safety in certain areas, but they often had to compete for funds and public attention in order to carry out their programs. He reported that in discussing SB 135 with Governor Brown and Senator Padilla, they recognized the need for a more centralized strategic and collective effort to create an integrated network.

Commissioner Ghilarducci said that after SB 135 was signed, a working group was created to develop a charter, define the kind of system and its parameters, and identify the steps needed to implement the system. He indicated that the working group's recommendations were still being reviewed, but a key recommendation pertained to governance, and proposed establishing a central, statewide point of coordination for earthquake and tsunami programs in California, with earthquake early warning being an important component of that effort. He said necessary aspects of the earthquake early warning system are research and development and science; funding and administrative operations; and the actual operational roll-out of programs, which would include a wide range of activities from public education, the annual ShakeOut, messaging, tsunami response and preparedness, earthquake early warning, and the strong ground motion sensing programs. Commissioner Ghilarducci said the California Geologic Survey has an array of about 1400 sensors in the ground throughout California, of which about 800 are purposed for other things, including about 150 sensors that can be repurposed to detect initial "P" waves immediately, thereby making the network more efficient and accelerating the pace of closing the gaps.

Commissioner Ghilarducci noted that with respect to the private sector, Governor Brown has been very clear that certain activities, including roll-out and support, can be carried out more efficiently and effectively by the private sector than by government, and that the private sector can be an important funding source.

Commissioner Ghilarducci remarked that due to the rapid pace of technological development, there will be many improvements within the next decade that will benefit members of the public. He said he oversees all of the 911 centers as part of the public safety communications network for California, and all centers are being broadbanded and transitioned to next-generation

equipment, including video capabilities. He emphasized the need to engage the private sector in supporting the advancement of earthquake early warning systems.

Commissioner Ghilarducci advised that he was contacted by representatives of the telecommunications industry who are very excited about this opportunity and wanted to know more about how the signals are being transmitted. He said signals are typically moved via fiber, with wireless capability in a few places. He observed that fiber networks can sometimes be damaged in large earthquakes, so the earthquake early warning system should leverage all of the networks to assure a speedy, immediate, and reliable signal.

Commissioner Ghilarducci said he told the telecommunications representatives that California was looking for private-sector funding, either hard cash or in-kind contributions. For example, he noted, working out an arrangement with the wireless industry for use of towers and installation of sensors would be most helpful. He recommended pursuing similar partnerships with rail transportation and utility systems, industries that would have a strong interest in ensuring the success of the earthquake early warning system. He noted that PG&E can put units on its lines to block power to transformers during an earthquake, and then restore power to an affected community 75 percent faster after an earthquake. Commissioner Ghilarducci pointed out that water and sewer utilities would also benefit from early warnings.

Commissioner Ghilarducci informed the Commission that Senate Bill 494 (Hill) incorporates recommendations from the subcommittee working group and provides for outreach to various stakeholder groups, including the rail industry, telecommunications, education, and health and medical organizations, pulling them all together to establish a governance system, and encouraging them to share resources to move forward with a set of common initiatives. He said SB 494 gives OES authority to develop a fund in the Treasurer's Office for public and private contributions to support the network over the long term. Commissioner Ghilarducci observed that governance is the first step in turning a project into a sustainable program. Commissioner Ghilarducci said the state is also working with USGS to consider repurposing some of its sensors.

Commissioner Michael Gardner thanked Commissioner Ghilarducci for his comments, and he noted that earthquake early warning is a much more complex issue than many people realize, and he cited the example of shutting off power distribution at substations. He pointed out that this would also entail shutting off power generation to avoid overloads, and generation can take time to restart and restore. He said users need to define who gets warnings and then develop guidelines for mandatory and voluntary responses. Commissioner Gardner remarked that building the system is comparatively simple, involving just time and money, but making the system work is a far more difficult challenge.

Commissioner Sweiss thanked Commissioner Ghilarducci for his work on the earthquake early warning system and its various components. He said that over the past few years, he has been working with experts in the Middle East to implement an earthquake early warning system there. He noted that the countries in the region tend to be small, so an effective network requires having sensors spread over a wide enough area to benefit all the countries there. Commissioner Sweiss stated that the Middle Eastern experts focused more on the social aspects of the early warning

system, and how it can be an opportunity to bring communities together and promote peace in that area.

Commissioner Sweiss observed that implementation of California's earthquake early warning system is imminent, and the network will be reliable and robust, but how the signals are used after that is a public policy matter in terms of training people how to respond. He recommended taking an opportunity on the social level by starting training now for communities, long before the system is launched.

Commissioner Sweiss said San Francisco has a Neighborhood Emergency Networks program in which the City provides training and advice to neighborhoods about establishing points of contact and responding to disasters. He noted that California should be investing in these kinds of programs to help prepare people so they are ready when the system is ready. He pointed out that the early warning system can provide jobs and conserve on government resources.

Commissioner Peggy Hellweg thanked Commissioner Ghilarducci for his update and summary of the issues. She strongly advocated calling the network an "earthquake information system" rather than an "early warning system." She noted that earthquake information historically came two or three weeks after an earthquake when records were mailed and analyzed by scientists. As data pipelines improved over recent decades, she said, information came within a few minutes, and now it comes after a few seconds.

Commissioner Hellweg explained that scientists are only a small part of earthquake early warning, because their role is limited to preparing the information, and running the networks, but they are not telling people how to use the information. She pointed out that early warning is not the answer to earthquake preparedness and recovery, because just taking immediate securing measures will not facilitate rapid recovery unless other preparedness actions are taken before an event. Commissioner Hellweg recognized the importance of early warning information as an improvement in the short term, but said California also needs to focus on its broader earthquake problem, both before and after an event.

Commissioner Tracy Johnson noted that Commissioner Sweiss talked about how San Francisco recognizes the potential impact of the public taking an interest in the system and causing others to make it a higher priority, and she expressed support for the idea of building grassroots support to encourage industry to devote more money to research and development.

Commissioner Hellweg requested that Mr. Rockabrand provide the Commission with a pre-screening copy of the messaging video.

XI. TRIBAL COMMUNITY OUTREACH INITIATIVE PILOT PROJECT

Chairman Strack introduced and welcomed Mr. Michael Kleeman, Senior Fellow, University of California, San Diego.

Executive Director Richard McCarthy noted that the Commission and CalOES are embarking on Phase Three of the "Totally Unprepared" campaign, which entails the marketing and promotion

of Commission and CalOES products. He said the Commission entered into a \$200,000 contract with UC San Diego to complete the work, and a tribal community outreach will be incorporated into the new contract.

Mr. Kleeman stated that the Commission recognized the importance of addressing the needs of California's Native American population, a group with special jurisdictional and legal status, and also a group that tends to be under-served and that may view government officials with suspicion. He explained that the purpose of the pilot effort was to make sure messages of earthquake safety and preparedness reach particular tribal areas that have high risks, heavier burdens of poverty, are largely uninsured, and in which state building codes do not apply, which often puts them and their facilities at risk. Mr. Kleeman noted that California's tribal groups vary greatly in their wealth, from rich groups like the Agua Caliente to small tribes without gambling or gaming, and the groups are self-governing.

Mr. Kleeman indicated that the pilot project focused on the tribal communities adjacent to the university, and it featured some very aggressive outreach. He said researchers began by having discussions with five different tribal councils, none of which agreed to participate. He noted that UC San Diego then coordinated its efforts with the American Red Cross, but that organization is viewed with suspicion in some communities. Mr. Kleeman said the Red Cross helped network with a group called the Tribal Emergency Preparedness Group and its Inter-Tribal Long-Term Recovery Foundation, and they introduced the researchers to a tribal communications organization. He emphasized that coming into these communities from outside does not work as well as finding ways within the communities to provide them with ideas and resources.

Mr. Kleeman discussed the project's multi-pronged outreach program to schools, tribal councils and affiliated groups, directly to the public through media and community events, presentations at fire preparedness fairs, and working with partners such as the Tribal Emergency Preparedness Group and the Red Cross on an all hazards-basis. He showed examples of outreach to schools with shake-table tests of gingerbread houses built by students. He said other contacts included fire chiefs in all tribal communities, articles in local media, and visits to homes to install smoke detectors.

Mr. Kleeman expressed his appreciation to the Inter-Tribal Long-Term Recovery Foundation and Americorps teams for their help in with outreach, recruitment at schools, and post-event impact surveys. He said the American Red Cross provided materials for a pillowcase project in elementary schools, fire-safe materials, smoke detectors, and training for Americorps volunteers and tribal personnel doing the installations.

Mr. Kleeman reviewed a list of tribal councils that were contacted and showed samples of the materials and displays for their communities. He said the media was blanketed through print, direct communications, posters in tribal community centers, tribal TV channels and radio stations, print and online publications, and digital media. He showed a sample of the banner ad focusing on tribal youth and tribal elders. Mr. Kleeman added that the youth in these communities typically have a very strong sense of responsibility for the elders in their communities.

Mr. Kleeman noted the goal of the pilot project was to spread the message through the youth at schools, get people prepared and provide kits, get people informed and working with local community organizations. He explained that earthquakes are not as much a concern in these communities as fire, so an all-hazards approach went over very well. He recommended that the Commission develop a similar program for Native American tribal groups throughout the state.

Mr. Kleeman said key lessons learned from the pilot project include

- Participation of local partners is essential, and tribal communities need to feel the program is theirs, with local voices, local images, local partners; recruiting the right local partners, developing materials, and working with local schools and community organizations may take a year or longer;
- Outcomes should be tracked and then tied to funding;
- Multi-dimensional approaches work: parents learn from what their children bring home from school; and
- An all-hazards approach allows access to difficult-to serve communities where earthquakes are not seen as a clear and present danger; for example, installing smoke detectors provides an opportunity to increase awareness of other hazards;

Commissioner Ghilarducci thanked Mr. Kleeman for this interesting work. He asked if the researchers worked through the Tribal Coordination Office at OES. Mr. Kleeman confirmed that OES' Tribal Coordination Office helped make introductions to contacts in the community. He said the researchers also worked with FEMA Title IX and their tribal contacts. He welcomed an opportunity for additional partnerships. Commissioner Ghilarducci invited Mr. Kleeman to meet with OES and the Governor's Office tribal liaison to discuss further outreach.

Mr. McCarthy reminded the Commission that outreach to tribal communities is very important to Governor Brown, and all state departments and agencies are required to develop outreach plans and information for tribal communities.

III. APPROVAL OF FEBRUARY 12, 2015 MEETING MINUTES (Out of Order)

Chairman Strack drew attention to the minutes of the February 12 meeting and welcomed comments.

ACTION: Commissioner Hellweg made a motion, seconded by Commissioner Carbajal, that:

The Commission approve the minutes of the February 12, 2015, meeting as presented.

* Motion carried, 12 – 0 (Commissioners absent during voting).

XIII. LEGISLATIVE UPDATE

Legislative Director Salina Valencia reported that members of the Legislature just returned from spring recess. She said she and Mr. McCarthy met with the outgoing and incoming Japanese General Consul, and California sent a legislative delegation to Japan and observed its earthquake early warning program.

Ms. Valencia advised that the Commission is not sponsoring any legislation this year, but a number of bills relating to seismic safety are being tracked at the request of the Business, Consumer Services, and Housing Agency, and the Governor's office. She drew attention to AB 81 (Wood), which would extend the seismic safety deadline for a particular hospital in Willits, California, to September 1, 2015, a facility in the process of being retrofitted and currently about 90 percent complete.

Ms. Valencia noted that another bill that appears to be moving is SB 602 (Monning), which would allow the California Earthquake Authority (CEA) to create a new voluntary financing tool for homeowners to mitigate and retrofit their homes. She explained that the CEA could finance up to 100 percent of the retrofit costs with loans secured by the real property, and homeowners could pay off the loans as part of their existing property tax bills.

Chairman Strack thanked Ms. Valencia for her report.

XIV. EXECUTIVE DIRECTOR'S REPORT

2015-16 Budget

Mr. McCarthy said commissioners can expect to receive the staff's 2015-16 budget projections within a few days. He noted that since the last meeting, he learned that the cash-out amount for Ms. Cogan's retirement had been over-estimated, and the Commission will receive \$42,000 reimbursement from two projects that it is required to review. He pointed out that the Commission still has \$50,000 in research overhead that has not yet been billed. Mr. McCarthy advised that the Commission has incurred about \$12,000 in costs to cover the Napa earthquake and produce its report. Those costs will be invoiced to the Commission's Earthquake Emergency Investigations Account.

Mr. McCarthy asked the Commission to authorize the staff to bill costs related to the Napa Earthquake to the Earthquake Emergency Investigations Account *

ACTION: Commissioner Gardner made a motion, seconded by Commissioner Hellweg, that:

The Commission authorize the staff to balance the budget as proposed.

* Motion carried, 12 – 0.

Expiration of Commissioner Terms

Mr. McCarthy said some commissioners' terms will expire on May 15, but they may continue to serve until July 15 unless they resign or are reappointed. He noted the Governor's Office has contacted some commissioners about their intent to reapply.

Mr. McCarthy indicated that he would email a list to commissioners showing each commissioner's term.

Upcoming Meeting Schedule

Mr. McCarthy noted that the Commission might be holding its June meeting by conference call, and the staff will contact commissioners in advance to let them know. He advised that Commissioner Wheatley will be hosting the Commission in October in Arcata, so commissioners should plan ahead for this visit to the North Coast. He commented that the area is challenged by its seismic and tsunami risks, as well as its potential isolation after a large earthquake.

McCarthy proposed setting the Arcata meeting for the second Thursday, October 8.

Commissioner Knudson asked if an August meeting would be held. Mr. McCarthy said he would have more budget information available before the June meeting, and the Commission can decide in June whether to hold an August meeting.

XV. PUBLIC COMMENT

There were no members of the public who wished to address the Commission.

XVI. MISCELLANEOUS AND GOOD OF THE MEETING

Commissioner Ian Parkinson said his area just held its annual disaster preparedness event, and participation continues to grow each year. He reported that he arranged for a shake table, and people seemed interested and engaged. He advised that he obtained a copy of a 1982 earthquake planning scenario book, and he provided copies to the Commission staff for anyone interested in reviewing the publication.

XVII. ADJOURN

Chairman Strack thanked the County of Santa Barbara and Commissioner Carbajal for hosting the meeting. There being no further business, the meeting was adjourned at 12:15 p.m.

Sue Celli
Office Manager

Approved by:

Richard McCarthy
Executive Director

State of California
Seismic Safety Commission

Memo

To: Commissioners

From: Richard McCarthy
Seismic Safety Commission
1755 Creekside Oaks Drive, Suite 100
Sacramento, CA 95833
(916) 263-5506

Date: 6/4/15

Subject: **The Nepal Earthquake: Lessons for California**

Background

NASA data and expertise provided valuable information for the response to the April 25, 2015, magnitude 7.8 Gorkha earthquake in Nepal. The quake caused significant regional damage and a humanitarian crisis. It was the strongest earthquake to occur in that vicinity since a magnitude 8.0 quake occurred in 1934 and caused more than 10,000 fatalities.

To assist in the disaster response efforts, scientists and engineers at NASA's Jet Propulsion Laboratory (JPL) led the coordination the NASA-wide response, provided technology that was used on the ground for search and rescue, and provided imagery that was used for damage assessment and situational awareness.

The response for the Nepal earthquake resulted in lessons learned on both the processes for providing JPL products for responders and how JPL technology and imagery can be helpful for a similar disaster in California. These lessons will be summarized in the presentation by Dr. Webb and captured in greater detail for JPL's Phase I/Pilot Project report to the Commission.

Commissioner Miyamoto spent several weeks on the ground in Nepal examining and observing the performance of structures. He will summarize his findings for the Commission and discuss possible lessons learned that may apply to reducing California's earthquake risk.

Recommendation

Staff recommends that Commissioners listen to the presentations from Dr. Webb and Commissioner Miyamoto. Staff requests Commission assistance on identifying lessons that could apply to California's efforts to reduce its seismic risk and speed economic recovery.

State of California
Seismic Safety Commission

Memo

To: Commissioners

From: Richard McCarthy
Seismic Safety Commission
1755 Creekside Oaks Drive, Suite 100
Sacramento, CA 95833
(916) 263-5506

Date: 6/4/15

Subject: **Simulation-Based Tools for Understanding and
Enhancing the Process of Post-Earthquake Recovery**

Background

A major earthquake occurring in one of California's urban centers could lead to thousands of casualties, hundreds of thousands of displaced households and billions of dollars in losses. The lives of the impacted residents are likely to be enormously disrupted.

In the aftermath of a destructive seismic event, communities will be faced with crucial decisions that will have long term effects on their vulnerability to future earthquakes. Leveraging the opportunities that are presented in the face of a disaster requires the development of planning and management processes that map out a path for long term recovery. Dr. Henry Burton's (Global Earthquake Model/UCLA) presentation will provide an overview of ongoing work to develop simulation-based tools and methods that can be used to understand and enhance the process of post-earthquake recovery. The key components of these tools include (1) the representation of earthquake-induced building damage using functionality-based limit states, (2) modeling the dynamic interactions and decisions of key stakeholders and (3) accounting for the socioeconomic vulnerability of the affected populations and (4) incorporating the effect of damage to lifelines.

Recommendation

Staff recommends that the Commission listen to Dr. Burton's presentation on this project. This is one of two projects the

Commission has contracted with the Global Earthquake Model. This is the first progress report on Project 1. The Commission is invited to advise Dr. Burton on the direction of the project and its final project.

State of California
Seismic Safety Commission

Memo

To: Commissioners

From: Richard McCarthy
Seismic Safety Commission
1755 Creekside Oaks Drive, Suite 100
Sacramento, CA 95833
(916) 263-5506

Date: 6/3/15

Subject: Report on Uniform California Earthquake Rupture Forecast

Background

The Uniform California Earthquake Rupture Forecast Version 3 (UCERF3) was developed to provide authoritative estimates of the magnitude, location, and average frequency of future, potentially damaging earthquakes in California under time-independent (*Field, 2014*) and time-dependent (*Field, 2015*) assumptions. The results were peer-reviewed and published in the *Bulletin of the Seismological Society of America* (references below). Additional information is also available at: <http://www.wgcep.org/UCERF3>. UCERF3 incorporates important improvements that overcome some of the limitations of the previous rupture forecast (UCERF2). These improvements include relaxing assumptions of fault segmentation, allowing earthquakes to rupture more than one fault, and using geodetic deformation measurements to constrain long-term slip rates on faults where that information would not otherwise be available. Also new to version 3 of the forecast is the assimilation of different types of observations using an optimization approach that allows a fuller exploration of different models that are consistent with the data, as well as their uncertainties, and will more easily incorporate information in future versions.

UCERF3 results are broadly consistent with previous findings from UCERF2, but with some significant changes due to model improvements. For example, the likelihood of M 6.5 to 7.5 earthquakes is reduced, due to changes in assumptions about fault segmentation, while that of larger earthquakes is increased. Changes to the hazard depends on many factors, but

the improved earthquake rupture forecast provides a more accurate portrayal of the earthquake threat, and will be used to inform updates to building codes, earthquake insurance products, emergency plans, and other risk mitigation efforts.

Recommendation

Staff recommends that Commissioner's listen to Commissioner Beroza's presentation and ask questions as needed. This is an informational item.

Hospital Building Safety Board

2014 ANNUAL REPORT to the
California Seismic Safety Commission

Executive Summary



**Hospital Building Safety Board 2013 Annual Report to the
California Seismic Safety Commission
Executive Summary**

Introduction

The Hospital Building Safety Board (HBSB, or “Board”) was established by Senate Bill 519 (Alquist) in the original Hospital Facilities Seismic Safety Act of 1973. The Board is a citizen advisory board with members who are recognized experts in health facility design, engineering, and construction. The Board’s purpose is to advise the Director of the Office of Statewide Health Planning and Development (OSHPD) on the administration of the Hospital Facilities Seismic Safety Act, and act as a board of appeals with regard to seismic safety, and fire and life safety issues relating to hospital facilities.

Composition of the Board

The Director of OSHPD appoints sixteen Board members from nominations submitted by professional associations, as specified in the Health and Safety Code, and has the authority to appoint three more as public ex-officio members. Appointed Board members serve 4-year terms with a maximum of two terms. Six statutory ex-officio members, representing state agencies whose programs interface with the hospital design and construction program, also sit on the Board.

This report contains the agendas, meeting reports, handouts and presentations, and decisions of the Hospital Building Safety Board for 2014. To view the entire report, please see the HBSB website: <http://oshpd.ca.gov/Boards/HBSB/>.

Additional Board-related information can be found on OSHPD’s website:
<http://www.oshpd.ca.gov/Boards/HBSB/index.html>.

Linda L. Janssen, Executive Director

Hospital Building Safety Board
400 R Street, Suite 200
Sacramento, CA 95811
(916) 440-8453
HBSB@oshpd.ca.gov

Active Committees for 2014

Administrative Processes and Code Changes Committee

Mr. Scott Karpinen, Chairperson

The Administrative Processes and Code Change Committee makes recommendations to OSHPD regarding the various plan review processes that the Facilities Development Division (FDD) offers to California’s hospital industry. The committee also reviews and makes recommendations for all proposed and emergency regulations prior to OSHPD’s submission to the California Seismic Safety Commission. In addition, the committee assists FDD in developing Policy Intent Notices and Code Application Notices.

This committee met three times in 2014.

Board Procedures Committee

Mr. D. Michael Foulkes, Chairperson

The primary objective of the Board Procedures Committee is to work with the Board Chairperson, Executive Director, and OSHPD to address Board policies, procedures, and bylaws, and to work on issues that improve the efficiency and cohesiveness of the Board.

This committee met once in 2014.

Education and Outreach Committee

Mr. Arlee Monson, Chairperson

The Education and Outreach Committee disseminates information about educational and training events offered by other organizations, and updates various publications of interest to California’s hospital industry, such as the “Guide for Working on Projects under OSHPD Jurisdiction—Tips from the Experts” and the “FREER Manual—a Guide for Field Reviewed Projects, Projects Exempt from OSHPD Plan Review and OSHPD Permit (Excluded) & Expedited Review Projects.” The committee plans and conducts seminars, and makes recommendations about possible training opportunities to be offered by OSHPD staff. In addition, the committee explores various methods of disseminating information such as posting recordings of presentations and training sessions on OSHPD’s website.

This committee met five times in 2014.

Active Committees for 2014 (Cont'd)

Instrumentation Committee

Mr. Lou Gilpin, Chairperson

The Instrumentation Committee reviews the status of existing strong motion instruments in hospital facilities. The committee annually reviews and prioritizes newly proposed candidate hospital buildings for strong motion instrumentation.

This committee met once in 2014.

Standard Details Committee

Mr. Bert Hurlbut, Chairperson

The Standard Details Committee develops and submits to OSHPD standard details for use by California's hospital industry design professionals. These standard details address issues such as wall framing and suspended ceilings. The committee will continue to develop standard details for mechanical, electrical, plumbing, fire and life safety, and accessibility.

This committee met twice in 2014.

Technology Committee

Mr. Eric Johnson, Chairperson

The Technology Committee (originally named "Advanced Technology Committee") is the Board's newest Committee and is tasked with keeping OSHPD abreast of new technologies being developed for hospitals to help ensure that current code and regulations do not prevent the use of technological developments in health care. The committee is developing a three-part workshop and enlisting hospital IT and clinical engineering representatives, along with industry vendors to educate and spark interest for the technologies being developed for the healthcare/hospital construction industries and the effects they could potentially have on hospital systems.

This committee met twice in 2014.

Appeals

There were no formal appeals submitted to the Board during the 2014 calendar year.

Hospital Building Safety Board Membership Roster for 2014

MEMBERSHIP CATEGORIES	NAMES	TERM EXPIRATION DATE	TERM OF SERVICE
Appointed Members (Appointed by OSHPD Director)			
2 structural engineers	Simin Naaseh Rami Elhassan	2/2016 8/2017	2 nd term 1 st term
2 architects	Richard R. Tannahill Bruce Macpherson	11/2018 8/2017	1 st term 1 st term
1 engineering geologist	Lou Gilpin	10/2015	1 st term
1 geotechnical engineer	John A. Egan	4/2015	2 nd term
1 mechanical engineer	Scott Karpinen	3/2017	2 nd term
1 electrical engineer	Eric C. Johnson	5/2018	2 nd term
1 hospital facilities manager	Carl Scheuerman	11/2018	2 nd term
1 local building official	Y. Henry Huang	5/2016	1 st term
1 general contractor	Bert Hurlbut	11/2014	2 nd term
1 fire/life safety representative	John Donelan	5/2018	2 nd term
1 hospital inspector of record	Brian Spindler	2/2016	2 nd term
3 public members	Enid K. Eck Poki Namkung Patrick M. Sullivan	10/2015 5/2015 11/2018	1 st term 2 nd term 1 st term
TOTAL	16		
Ex-Officio Members			
OSHPD, Director	Robert P. David	No Term of Office Stipulated	
State Fire Marshal	Tonya Hoover Ernie Paez (Delegate)		
State Geologist	John Parrish Tim McCrink (Delegate) Jennifer Thornburg (Delegate)		
Building Standards Commission, Executive Director	Jim McGowan Michael Nearman (Delegate)		
Department of Public Health, Director	Ron Chapman, M.D., MPH Eric Morikawa (Delegate)		
Facilities Development (OSHPD), Deputy Director	Paul A. Coleman		
TOTAL	6		
Director Appointed Ex-Officio Members (Serve at pleasure of Director)			
3 members	D. Michael Foulkes Trailer Martin Michael O'Connor	No Term of Office Stipulated	
TOTAL	3		
TOTAL HBSB Members	25		

Hospital Building Safety Board Appointed Members

<p>John A. Egan, G.E. AMEC Geomatrix, Inc. 2101 Webster Street, 12th Floor Oakland, CA 94612 (510) 663-4292 john.egan@amec.com Geotechnical Engineer, HBSB Chair Original Appt. – 04/07; Term Expires -04/2015</p>	<p>Arlee Monson, AIA Principal, SmithGroup, Inc. 301 Battery Street, 7th Floor San Francisco, CA 94111 (415) 227-0100 arlee.monson@smithgroup.com Architect, HBSB Vice-Chair Original Appt. - 05/10; Term Expires – 05/2014</p>
<p>Robert E. Chason 618 Francisco Place Davis, CA 95616 (530) 848-3024 (cell) rchason@sbcglobal.net Public Member Original Appt. - 11/13; Term Expires – 11/2017</p>	<p>John Donelan 35175 San Carlos Street Yucaipa, CA 92399 (909) 795.5262 (909) 260.8945 (cell) cowdogfire@aol.com Fire and Life Safety Representative Original Appt. - 05/10; Term Expires – 05/2018</p>
<p>Enid K. Eck, RN, MPH Kaiser Permanente Quality and Risk Management 393 E. Walnut Street Pasadena, CA 91188 (626) 405-6051 enid.k.eck@kp.org Public Member Original Appt. – 10/11; Term Expires – 10/2015</p>	<p>Rami M. Elhassan, Ph.D., SE Principal IDS Group 1 Peters Canyon Road, Suite 130 Irvine, CA 92606 (949) 387-8500 Rami.Elhassan@idsqi.com Structural Engineer Original Appt. - 08/13; Term Expires – 08/2017</p>
<p>Lou Gilpin, Ph.D., CEG Principal Geologist, Gilpin Geosciences, Inc. 2038 Redwood Road Napa, California 94558 (707) 251-8543 lgilpin@gilpingeosciences.com Engineering Geologist Original Appt. – 10/11; Term Expires – 10/2015</p>	<p>Y. Henry Huang, PE., CBO 7552 Los Trancos La Palma, CA 90623 (714) 431-4123 (562) 544-1110 cell y.henry.huang@gmail.com Local Building Official Representative Original Appt. – 5/12; Term Expires – 5/2016</p>

HBSB Appointed Members (Cont'd)

<p>Bert Hurlbut Stanford University Medical Center 1520 Page Mill Road, 2nd Floor Palo Alto, CA 94304 (650) 380-6858 (cell) bhurlbut@stanfordmed.org General Contractor Original Appt. – 11/06; Term Expires – 11/2014</p>	<p>Eric C. Johnson, PE President, ECOM Engineering, Inc. 1796 Tribute Road, Suite 100 Sacramento, CA 95815 (916) 641-5600 ecj@ecomeng.com Electrical Engineer Original Appt. - 05/10; Term Expires – 05/2018</p>
<p>Scott Karpinen, ME Frank M. Booth Design Build Company 4220 Douglas Blvd., Suite 5 Granite Bay, CA 95746 (916) 878-3827 scottk@fmbdbc.com Mechanical Engineer Original Appt.– 03/13;Term Expires– 03/2017</p>	<p>Bruce Macpherson Puchlik Design Associates, Inc. 859 South Raymond Avenue Pasadena, CA 91105-3223 (626) 304-9215 BMacpherson@puchlikdesign.com Architect Original Appt. - 08/13; Term Expires – 08/2017</p>
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State of California
Seismic Safety Commission

Memo

To: Seismic Safety Commission

From: Fred Turner, Staff Structural Engineer
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Date: June 3, 2015

Subject: **Update from the Ad Hoc Committee on Seismic Risks of Buildings**

In late 2013, the Commission created an Ad Hoc Committee to generate a guideline for local governments on how to identify and manage seismic risks of buildings. The Committee is chaired by Commissioner Randy Goodwin and includes Commissioners Kit Miyamoto and Fuad Sweiss. The attached draft is a 12-to-13-page overview of the common types of vulnerable buildings and recommended steps for managing their risk that local governments have commonly used in California. Since the full Commission last reviewed an earlier draft at the February 2015 hearing, the Committee met on April 9th, responded to input from other Commissioners and OES staff, and developed the attached draft for review and comment.

The Committee hopes to eventually publish this overview online after considering additional public input and obtaining Commission concurrence. It could also be followed by appendices developed later by the Committee with input from the full Commission. The appendices will provide local governments more detailed advice in the form of an online resource. The Committee has started its review of the appendix.

Commission staff also met with Commissioner Goodwin on May 18th when we discussed the need to hire a technical editor and graphics designer. Staff is pursuing several leads and will report on progress at the June 11th hearing.

Staff Recommendation

The Commission is asked to review and comment on the attached draft at the June 11th hearing and come prepared to discuss next steps for obtaining broader input on future drafts.

Guide to Identify & Manage Seismic Risks of Buildings For Local Governments

Draft Version 14

April 10, 2015

Overview

California's 14 million buildings include some of the most modern and earthquake-resistant in the world. However, most older buildings could be damaged and perhaps less than 5 % could collapse in severe shaking. That may seem like a few, but collapse can cause significant life loss, injuries and substantial social and economic disruption amounting to hundreds of billions of dollars. So where are these buildings? What can be done about them?

This guidebook summarizes California's laws and regulations to assist governments and to identify and reduce collapse risks, as well as best practices that building owners can take to further manage the risks.

Common Types of Collapse Risk Buildings¹

Buildings may be vulnerable to earthquakes because they were:

- Not constructed to comply with codes and standards, or
- Constructed before earthquake resistance was required in the 1930's or
- Built to codes that were later found to be inadequate, or
- Improperly altered, repaired or poorly maintained

Based on performance in past earthquakes, the following types of buildings generally pose exceptionally high risks of collapse near active earthquake faults:

- Pre-1940's unreinforced masonry (URM), primarily brick, buildings
- Pre-1980's concrete frame buildings
- Pre-1980's buildings with soft or open lower stories, unbraced crawl space walls below first floors, or other irregular shapes, including homes on steep hillsides
- Pre-2000's buildings with precast concrete tilt-up walls or masonry walls, and precast concrete parking structures.

Other types of buildings pose generally lower or harder-to-identify risks:

- Pre-2000's steel buildings
- Buildings that are not adequately constructed, repaired or maintained

¹ See Appendices for more specific information, benchmark years, and references.

- Buildings on sites subject to fault displacements, landslides, or soil liquefaction

Buildings that collapse or partially collapse can also cause fires, property damage and disruption to surrounding properties, neighborhoods and public rights of way. Californians live, work, go to school, shop and worship in some of these buildings.

The Most Effective Methods of Managing Collapse Risk Buildings

Ensuring that building construction and alterations are properly designed by licensed professionals using plan reviews and inspections by qualified regulators is the most effective way for governments to identify and reduce the risks of collapse.

Who is Responsible?

Building Owners are responsible for ensuring their buildings are safe and are responsible for disclosing a building's vulnerabilities to occupants. Building safety is typically regulated by the respective agencies at the federal, state or local level. Local jurisdictions are responsible for reviewing construction plans, issuing building permits and inspecting construction for most buildings, including local essential service facilities such as Fire and Police Department facilities. State agencies regulate (check plans and inspect) building safety for public schools, hospitals and state essential services buildings. Federal agencies regulate building safety for Federal Buildings and support research and development to improve building standards. Regulatory permits are required for new construction, alterations, and seismic retrofits of existing buildings at each level.

Nexus for Public/Private Partnerships to Manage Collapse Risks

Most buildings are privately-owned, but if they were to collapse, they would adversely impact the public spaces around their perimeters, create demands on government emergency and recovery services, and disrupt social and economic activities in communities. Both building owners and government agencies have major stakes in managing earthquake risks. Building owners stand to lose property values while governments lose tax revenue after earthquakes. It is in everyone's best interests for the government and building owners to collaborate in identifying vulnerable buildings and improving their earthquake resistance.

Steps to Managing Collapse Risk Buildings

There are many options to manage seismic risk presented by buildings that are prone to collapse. They range from passive approaches that may gradually reduce collapse risk for some buildings over decades to active approaches that require seismic evaluations and retrofits within a few years.

Owners are often unaware or reluctant to find out about the earthquake resistance of their buildings. There may only be a few key opportunities during the useful lives of buildings to identify and address collapse risks, such as major alterations or changes in use. As a result, most buildings have not been seismically evaluated or upgraded since they were originally constructed.

Pre-1930's buildings were most likely constructed without considering earthquake resistance since California's building codes did not include earthquake safety requirements before 1933. When buildings are sold, the California Seismic Safety Commission's *Commercial Property Owner's Guide to Earthquake Safety* and the *Homeowner's Guide to Earthquake Safety* encourage or require sellers to disclose typical earthquake weaknesses to buyers. When major buildings are refinanced, lending or insurance companies may require seismic evaluations as a condition for new mortgages or policies. When buildings undergo major alterations, additions or repairs, local governments may require seismic evaluations or retrofits as conditions for construction permits.

If a community relies on building owners to manage their own risks, the owners who are more conscientious, that have long-term interests in their community, and are aware of earthquake risks may eventually replace or retrofit their vulnerable buildings when they find it convenient. But risk reduction progress is expensive and will typically be slow and uneven. In the meantime, those who occupy collapse risk buildings and rely on streets and sidewalks nearby are exposed to their risks as well including the prospect of years of disruption after earthquakes.

Success Story

Saint Helena's Unreinforced Masonry Building Program

Saint Helena has 33 buildings in their inventory and the owners have retrofitted all of them. The City provided numerous incentives including building permit fee waivers, creation of a historic district to take advantage of a 20% Federal Tax Credit, use of the State's Mills Act to preserve facades and reduce costs, and a streamlined design review process.

The public policy questions that warrant consideration by government agencies, building owners and the public are:

- 1) How effective are current policies regarding earthquake safety?
- 2) How many years will policies take to significantly reduce collapse risks in the community?
- 3) What other earthquake risk management alternatives merit consideration?

Invariably, the public incorrectly assumes that government agencies require existing buildings to be earthquake resistant. But some buildings are poorly-maintained, built before seismic requirements, and quite vulnerable. Many people are surprised to learn that the latest earthquake safety regulations do not apply to existing buildings unless they undergo major alterations, additions, or repairs.

Communities assume that their government officials will take initiatives in long-term planning and place earthquake safety priorities into context with other competing priorities. And California has many examples of government agencies that have undertaken earthquake risk management initiatives. This guide summarizes four steps and seven common options:

Step 1: Create Opportunities for Education, Dialogue and Public/Private Participation in Decisions about Buildings

Recommend Building Officials, Emergency Managers, City Councils and Boards of Supervisors, and the private sector actively engage and inform the public about issues related to collapse risk buildings and alternatives for managing their risks. Consider keeping stakeholders informed about who makes decisions, when, and how they can participate and influence policymaking. Inform building owners about the variety of seismic upgrade options that are available to building design professionals.

Success Story

Fremont's Soft Story Apartment Building Program

In 2007, Fremont required owners of 30 apartment complexes to retrofit. The City designed their ordinance to result in no occupants being relocated from their units during construction. Fremont also reimbursed owners for all plan check and permit fees once the retrofits were completed. Owners could apply for time extensions due to financial hardship. Fremont demonstrated remarkable success, albeit for a relatively small portion of their apartment building stock.

Step 2: Estimate the Size and Nature of Collapse Risk

Inventories can provide insights into a community's vulnerability by picking from several approaches ranging from:

- Surveys by walking or driving through neighborhoods that have concentrations of older buildings (See Step 3, Option 2 below)
- Individual seismic evaluations of all vulnerable or representative buildings (See Step 3 and Options 2 to 5 below)
- Compare efforts in other similar communities that may have already conducted such studies that might provide benchmarks for inferences and contrast

Learning about the ages of buildings, their occupancies, sizes, locations and states of repair will help quantify the potential for deaths, injuries, downtime, economic and social losses from damaging earthquakes. Reviewing long-term plans for economic improvement, historic preservation, transportation, and redevelopment will help identify opportunities and constraints for reducing earthquake risks while accomplishing other objectives. Inventories will also help identify buildings that have already been retrofitted or replaced and the rate at which changes are already taking place. Even if no further steps are contemplated, community leaders, emergency managers, and building officials will gain a better sense of what to expect and how to respond to future earthquakes.

Success Story

Los Angeles' Unreinforced Masonry Building Retrofit Program

The City of Los Angeles spent over a decade requiring owners to retrofit or replace over 8,000 unreinforced masonry buildings. At the time of the Northridge Earthquake in 1994, over 6,000 had been retrofitted and 2,000 replaced. Fortunately, no one was killed in these buildings during the earthquake. While not all retrofits were entirely successful and lives could have been lost if the earthquake had occurred at another time of the day, the city's recovery efforts were accelerated by reduced damage and disruption in these buildings.

Step 3: Develop & Consider Options for Identifying and Mitigating Collapse Risks

Seven options to manage collapse risks range from implementing existing regulations to enacting mandatory retrofit programs as well as several options in-between. They are ranked below from lowest to highest according to their difficulty to implement and their potential for resistance from building owners:

- **Option 1: Rely on Attrition and Current Triggers for Alterations in the Building Code:**

Older buildings are periodically replaced by newer, typically more earthquake-resistant buildings as communities evolve. This attrition typically occurs at rates of less than two percent of the building stock per year.

Chapter 34 of the California Building Code requires owners to consider seismic safety in existing buildings when major alterations, additions, and repairs are contemplated. However, these regulations tend to discourage owners due to uncertainties and other triggered costs like fire safety and accessibility upgrades -a “Pandora’s Box”. The cumulative effects of prior alterations are required to be considered when altering or constructing additions to existing buildings. Voluntary seismic improvements are encouraged by the building code, which allows owners discretion when proposing improvements.

State laws require disclosures of typical earthquake weaknesses at the time of sale for certain dwellings and encourage disclosures for certain commercial buildings. These disclosures can trigger voluntary retrofits.

This option is consistent with policies in most jurisdictions except for unreinforced masonry buildings in regions of high seismicity. A community’s Building Official will have more information and a sense of how effectively and at what rate voluntary seismic improvements are taking place.

Success Story

**San Luis Obispo’s
Downtown Revitalization
Program**

The City of San Luis Obispo requires that all of their 126 unreinforced masonry buildings be retrofitted by 2017. The City provided free downtown parking for contractors, \$5,000 incentives for each owner that retrofits, grants for up to \$25,000 for some owners and permit fee waivers. Most importantly the downtown business community is experiencing a major revitalization with enhanced foot traffic, retail and restaurant activity as a result of the improvements.

- **Option 2: Develop Reliable, Detailed Inventories of CollapseRisk Buildings:**

Starting from information gathered in Step 2, more-detailed inventories can rely on:

- Samplings of buildings to infer characteristics of a larger inventory
- Records of building permits for past seismic evaluations as well as triggered and voluntary seismic retrofits

- On-line street views and other geographic information systems
- Sanborn maps that depict construction types
- Building permit and tax assessor data
- Archives of Architectural, Civil, and Structural Engineering firms
- Redevelopment Plans or Transportation Corridor Studies
- Maps of liquefaction zones and areas with landslide potential
- Registers of Historical Buildings and Surveys of Historic Districts, or
- Adopted versions of the Building Code in effect when buildings were originally constructed or retrofitted

These can help determine construction types, sizes, heights, and occupancy classifications and overall vulnerability to earthquakes.

Detailed guidance and checklists for conducting inventories can be found in the Appendices.

- **Option 3: Develop Seismic Performance Options:**

Governments and other stakeholders can consider a variety of alternatives for describing how buildings can be expected to perform in earthquakes ranging from unknown, to collapse, to partial, basic and enhanced seismic performance objectives for retrofits or replacements. This will enable a dialogue in the community about acceptable levels of risk, recovery costs and durations of social and economic interruption. Discussions can highlight the differences between the expected performance of newer buildings compared with the performance of existing buildings. Typical structural performance descriptions or objectives are:

- **Not Considered or Unknown**
- **Immediately Dangerous** – and not safe to occupy, or
- **Collapse Risk** – considered safe enough to occupy, or
- **Collapse Prevention** –with little or no margin of safety

Success Story

San Francisco’s Earthquake Safety Implementation Program

San Francisco engaged its citizens in collaborative ways to develop a Community Action Plan for Seismic Safety to reduce vulnerabilities with priorities tailored to the City’s unique building stock and socio-economic conditions. The plan’s recommendations are now being managed through a new 30-year Earthquake Safety Implementation Program. First steps include addressing the most vulnerable soft story apartment buildings. Next in line are older private schools and with plans to address non-ductile concrete buildings later.

- **Life Safety** – with larger margins of safety beyond collapse although buildings may not be occupiable after damaging earthquakes, or
- **Immediate Occupancy** – although not necessarily operational, due to damage to building contents, non-structural systems, or lifelines

Typical performance objectives for nonstructural portions of buildings such as equipment, electrical, plumbing and ventilation systems, ceilings, partitions and cladding are:

- **Not Considered or Unknown**
- **Life Safety** –to avoid death and injury, but not necessarily keep systems in place, or
- **Position Retention** – to keep systems in place during shaking, but not necessarily operational, or
- **Operational**

Detailed advice about seismic performance options is in the Appendices.

- **Option 4: Undertake Seismic Screenings:**

Two techniques for screenings are available:

- *Rapid Visual Screening of Buildings for Potential Seismic Hazards* (FEMA 154, a national guideline) is a simple procedure that can be accomplished with smart phones from the sidewalk and no access to interiors.
- *Seismic Evaluation and Retrofit of Existing Buildings – Tier 1 Seismic Screening* (from ASCE 41-13, a national standard) is a somewhat more in-depth procedure that can be accomplished in under 1 day for most buildings with interior access.

The results of these screening techniques can be incorporated into community-specific

vulnerability databases for more reliable loss estimates for large cities and counties. Loss estimates can also help generate what-if scenarios for an expected range of earthquakes as well as annualized losses based on screening data unique to each community.

Success Story

San Diego’s Downtown Parapet Bracing Program

The City of San Diego includes parapet bracing as a key part of their downtown redevelopment effort. In light of their somewhat lower risk than in other parts of California, they considered the risks posed by other vulnerable aspects of brick buildings to be too costly to address. Bracing was accomplished with historic preservation in mind so that the aesthetics of the brickwork was not adversely impacted by the installation of new wall anchors.

- **Option 5: Require Seismic Evaluations and Ratings of Buildings:**

Tier 1, 2, or 3 evaluations using ASCE 41-13 of a sampling of representative buildings or all buildings that have a particular type of exceptionally high risk construction will provide comprehensive insights into vulnerabilities. This information can help scope retrofit costs and disruptions to occupants and neighbors. The results of ASCE 41 evaluations can be used to generate safety ratings and compare them with the performance provided by standards for new construction such as *Minimum Design Loads for Buildings (ASCE 7)*.

More detailed evaluations using such techniques as the Applied Technology Council's Performance Assessment Calculation Tool (PACT) can be used to assign ratings for repair costs and recovery.

Detailed advice about seismic evaluations is in the Appendix.

- **Option 6: Encourage Voluntary Seismic Retrofits or Replacements:**

Voluntary retrofits or replacements will be influenced by:

- Real estate market conditions, including property values, rental and vacancy rates
- Frequencies of changes in occupancies such as when buildings are sold or leases are started or renewed
- Code-based triggers of seismic evaluations and retrofits including those for alterations, additions, or repairs
- Decisions that are altered by awareness of stakeholders when ratings and disclosures become known pursuant to Options 1 or 5
- Ordinances that may require notification of owners of exceptionally high risk buildings and specify seismic performance objectives for evaluations and retrofits and periodic reporting to the jurisdiction so that retrofit progress can be monitored
- Redevelopment and intensification of properties
- Incentives such as reducing building permit fees or reduction of disincentives such as waiving parking requirements

- **Option 7: Consider Requiring Retrofits or Replacements :**

Mandatory retrofit ordinances will generally require retrofits by owners within time frames of multiple years. Ordinances will typically include:

- Notification of owners of exceptionally high risk buildings near active earthquake faults

- Minimum seismic performance objectives and retrofit requirements
- Financial incentives and removal of disincentives
- Procedures for regulators to:
 - Record certificates of collapse risk on property deeds
 - Ensure effective enforcement of evaluations, retrofits or replacements within prescribed time frames
 - Adjust the timeframes for compliance in response to changing economic conditions, construction costs, and delays, and to allow time for buildings to be sold to others willing to retrofit
 - Preserve qualified historical resources
 - Require demolition of high risk buildings only as a last resort when retrofit alternatives are found not to be feasible
 - Monitor and report progress to policymakers.

Step 4: Other Key Management Considerations

Recommend that communities, building owners and government officials also consider:

- Hazards unique to each community from nearby faults, including the extents and expected rates of occurrence of damaging ground motions, landslides, liquefaction, tsunamis, fires and other effects
- Potential consequences of major, secondary effects such as water damage, non-structural and contents damage.
- Costs, benefits, affordability and the time needed to reduce collapse risks effectively
- Financial, zoning and use incentives that help owners invest in building safety
- Including seismic safety objectives with other planning, zoning, economic, social development, and historic preservation initiatives
- Seismic retrofits can trigger other requirements such as disabled access compliance, fire resistance and repairs that can substantially increase project costs and discourage building owners from taking action.
- Risks to a community's tax base posed by altering the building stock or damaging earthquakes, and
- Post-earthquake recovery times and how they might be reduced by pre-earthquake risk reduction

Since earthquakes are relatively rare, communities will typically have the advantage of many years, possibly decades, before future damaging earthquakes occur. But retrofits and replacements of collapse risk buildings are quite costly, so they can't be readily accomplished in the short term. Therefore, adopting a long-term perspective is typically sound practice and includes:

- Building safety regulatory oversight by well-trained and qualified professional inspectors and plan reviewers, who are generally licensed or certified, to ensure that new buildings are earthquake resistant and every opportunity is taken to effectively reduce the risks posed by older buildings
- Preparedness, public education, and emergency management measures including barricading, stabilization and repair ordinances are in place to address the anticipated risks that damaged buildings can pose
- Management by metrics using periodic progress reports to keep the public and policymakers abreast of the size and nature of the collapse risks posed by buildings, what has been done about them over time, how soon will such risks be significantly reduced to manageable levels, and how the rate of retrofit and replacement progress compares with the expected rate of occurrence of future earthquakes
- Incorporation of retrofit and replacement initiatives into a community's multi-hazard mitigation plans and coordination with other long-term planning and growth objectives, and
- Periodically reevaluating progress and revising priorities and strategies especially after damaging earthquakes

Appendices

The California Seismic Safety Commission draws from the past experiences of hundreds of local governments to generate this Guide and Appendices that can hopefully help carry out the options described above. Advice in the Appendices can be considered a toolbox from which local governments can draw and adapt to their community's unique circumstances. Checklists, success stories, financial incentives, and references for more detailed information might prove useful to local governments when designing initiatives to manage collapse risks.

The Commission is interested in feedback from users of this guide and the Appendices so that it can make periodic improvements and corrections. We welcome your ideas, so please send your comments to: feedback@stateseismic.com