

Annual Report

2017 ALFRED E. ALQUIST SEISMIC SAFETY COMMISSION

Mission: To provide decision makers and the general public with cost-effective recommendations to reduce earthquake losses and expedite recovery from damaging earthquakes.

Alfred E. Alquist Seismic Safety Commission (SSC)

Tel (916)263-5506
Fax (916)263-0594

1755 Creekside Oaks Drive,
Suite 100
Sacramento CA 95833

www.ssc.ca.gov

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Executive Summary

The following annual report provides a brief overview of the projects that the Alfred E. Alquist Seismic Safety Commission (SSC) was engaged in 2017. Once the projects are concluded, any reports or studies produced are placed on the SSC “publications” webpage at <http://www.ssc.ca.gov/pub.html>

The SSC is the primary seismic resource for the State of California dedicated to reducing earthquake risk for the people of California since 1975. The SSC investigates earthquakes, reports on earthquake-related issues, and evaluates and recommends to the Governor and Legislature policies needed to reduce earthquake risk. Although the SSC does not have any governing authority on earthquake policy, the SSC strives to ensure a coordinated framework for establishing earthquake safety policies and programs in California.

Richard McCarthy,
Executive Director

SSC’s Vision

To provide leadership in implementing and achieving the goals and objectives in the California Earthquake Loss Reduction Plan, including to advance learning about earthquakes and risk reduction in both the short and long term, advance the earthquake-resistant designs of buildings and other important structures, and advance the preparedness and emergency response systems for earthquakes.

2017 SSC Staff

Richard J. McCarthy-----Executive Director
Robert Anderson-----Senior Engineering Geologist
Lena Daniel-----Chief Administrative Manager of Operations
Michael Orille----- Project Analyst
Henry Reyes-----Structural Engineer (Special Projects)
Fred Turner-----Senior Structural Engineer
Salina Valencia-----Director of Legislative/ Communications

2017 SSC Commissioners

Michael Gardner	Local Government
Tracy Johnson	Public Utilities
Senator Anthony Cannella	California State Senate
Assemblymember Ken Cooley	California State Assembly
Mark Ghilarducci	California Office of Emergency Services
Mia Marvelli	California Building Standards Commission
Chester Widom	California State Architect
Randy Goodwin	Architectural & Planning Building Official
Dr. Kit Miyamoto	Structural Engineer
Jorge Meneses	Geotechnical Engineer
Ian Parkinson	Emergency Services
David Rabbitt	Local Government
Timothy Strack	Fire Protection
Andrew Tran	Insurance
Cindy Silva	Local Government
Fuad Sweiss	Mechanical Engineer
Edward Valenzuela	Local Government
Ivan Wong	Seismologist
Vacant	Geologist
Vacant	Social Services

Authority & Statute

The California Seismic Safety Commission (SSC) was established in 1975 to advise the Governor, Legislature, state and local agencies, and the public about strategies to reduce earthquake risk (Government Code §8870, et seq.).

The SSC is an independent unit within the Business Consumer Services and Housing Agency (BCSH) and offers a broad perspective of the overall “seismic risk” to the state, sets consistent policies and goals without regard to political agendas and makes independent findings and recommendations without agency bias or repercussions.

The SSC investigates earthquake-related issues and evaluates and recommends to the Governor and Legislature policies and programs needed to manage earthquake risk.

To ensure a coordinated framework for establishing earthquake safety policies and programs in California, the SSC uses the expertise of its members, experienced in earthquake-related fields, to review, evaluate, and translate scientific information and make recommendation to guide and influence earthquake safety policies.

The SSC coordinates the State’s mitigation efforts through publication and promotion of the California Earthquake Loss Reduction Plan, which serves as the State’s strategic earthquake plan, guiding the executive and legislative branches. It acts efficiently after earthquakes to gather information and recommend policy changes to incorporate lessons learned and activities to enhance seismic safety.

The SSC does not have regulatory authority over any specific programs or agencies but it is empowered with quasi-judicial and investigative powers to examine and conduct studies on seismic safety policies and programs across lines of governments and the private sector.

The SSC is composed of 20 Commissioners. There are 15 Commissioners who are appointed by the Governor, with expertise in earthquake or disaster related fields, as well one legislative Member from the California State Senate and the California State Assembly. Three Commissioners represent the Governor’s Office of Emergency Services, Division of State Architect, and Building Standards Commission. The SSC is supported by 6.5 staff members.

Financial Summary

The SSC has several different funding sources. The following provides background information on the SSC's various funding sources.

Insurance Fund

California Insurance Code (CIC) section 12975.9 established a Seismic Safety subaccount in the Insurance Fund and imposed an assessment to fund the Alfred E. Alquist Seismic Safety Commission (SSC) upon appropriation by the Legislature. On July 1, 2012, this assessment became inoperative as the SSC was funded by the General Fund in Fiscal Year (FY) 2012-13, and funded by a General Fund loan in the amount of \$1,122,000 in FY 2013-14. As of June 30, 2017, the SSC has repaid \$407,000 of the General Fund loan. Assembly Bill 98 (Chapter 27, Statutes of 2013) re-established a Seismic Safety subaccount, effective June 27, 2013, and imposed an assessment on each person who owns real property, commercial or residential, that is covered by a property insurance policy to fund the SSC. The California Department of Insurance (CDI) shall set the assessment annually every August 1 for all commercial and residential earned property exposures reported during the previous calendar year. This assessment supports the operations of the SSC and allows a multi-year repayment of the General Fund loan. Assessment Methodology Pursuant to CIC section 12975.9, the annual assessment shall be based on the number of earned property exposures from both commercial and residential insurance policies, the amount required for the support of the SSC, the actual collection and administrative costs of the department, and the maintenance of an adequate reserve, but shall not exceed fifteen cents (\$0.15) per earned property exposure.

Gift Agreement, California Research and Assistance Fund

In August of 2007, the SSC was awarded a one-time allocation of funds, in the form of a Gift Agreement, from the California Research and Assistance Fund (CRAF). The CRAF funds the SSC research and education projects. As outlined in the CRAF Gift Agreement, the SSC is entitled to collect up to 10 percent overhead expenses for contracts awarded through the fund.

Contract with the California Public Utilities Commission (CPUC)

The SSC also receives reimbursement from the California Public Utilities Commission (CPUC). Pursuant to Assembly Bill No. 361, approved by the Governor, and under the California Emergency Services Act, the CPUC created an independent disaster council for the purposes of "planning" activities related to initial and subsequent assessments of the Diablo Canyon powerplant site. These assessments include the investigation and interpretation of environmental factors such as seismic conditions. The bill requires the CPUC to convene, or continue, until August 26, 2015, an independent peer review panel

to conduct an independent peer review of enhanced seismic studies and surveys of the Diablo Canyon Units 1 and 2 powerplant, including the surrounding areas of the facility and nuclear waste storage.

Ch. 399, 712. (b) The independent peer review panel shall contract with the Energy Commission, the California Geological Survey of the Department of Conservation, the California Coastal Commission, the Alfred E. Alquist Seismic Safety Commission, the Office of Emergency Services, and the County of San Luis Obispo to participate on the panel and provide expertise.

In accordance with Agreement number 11IA5937, executed on December 1, 2011, between the CPUC, California Seismic Safety Commission (CSSC), California Coastal Commission (CCC) and the California Energy Commission (CEC) the CPUC agrees to compensate the CSSC for authorized expenditures incurred in accordance with the rates specified and made part of the Agreement. Total expenses claimed by the CSSC under the Agreement, include but are not limited to Travel and Other Expenses. CSSC shall be entitled to the specific sum not to exceed the total amount of \$188,000 through the duration of the Agreement for staffing and travel costs.

SSC Operating Budget Fiscal Year 2016/2017

Appropriated Operating Budget	\$1,249,000
Actual Operating expenses	\$1,215,000
Cost Savings	\$34,000

Projects

Earthquake & Tsunami Classroom Curriculum

Humboldt State University partnered with the SSC for a project to deliver preparedness information to elementary school students and their families in the North Coast region. The framework of the project includes the development of a web-based interactive earthquake and tsunami education program that will include curriculum and preparedness information. This project will provide web based materials that fit into the current state teaching framework and address the priority needs in the State for earthquake and tsunami outreach.

School districts in both Humboldt and Del Norte counties are using the children's book, "The Extraordinary Voyage of the Kanome" for a web based interactive earthquake and tsunami education program to deliver earthquake and tsunami preparedness information to elementary aged students and their families. Many web based tsunami education tools have been developed and the book has been reprinted in English as well as Spanish.

An update of this project was presented to the SSC at the July 2017 SSC meeting. The book "The Extraordinary Voyage of the Kanome" has gone into its third printing thanks to outside funding raised by Dr. Lori Dengler, the contractor and author of the book. At that time, the project was on time.

This project is scheduled for completion in the spring of 2018.

Jet Propulsion Laboratory (JPL) project Implementing JPL Technologies for Improving Earthquake Resiliency in California

This project was approved by the SSC at its May 11, 2017 meeting. The project consists of two parts

- A) The use of JPL air and space borne radar technologies to assess ground deformation and damage for use in planning recovery activities.
- B) Methane detection and mapping from aircraft after an earthquake.

The project was selected based on a proposal developed by JPL for the SSC that was generated from a JPL/SSC study completed in 2016. The findings and recommendations from this report entitled *Select Technologies and Capabilities to Improve Earthquake Resiliency in California* recommended that the SSC support the use of radar, Light Detection And Ranging (LIDAR) infrared and optical imaging from aircraft and/or spacecraft to determine the disposition of faults as well as ground deformation and

damage to buildings and infrastructure after earthquakes. These technologies had been used in a limited capacity mainly for research since 2009. The SSC is attempting to see which technologies would be useful in determining losses after a earthquakes as well as helping speed recovery with products that would be supplied to decision makers and other emergency management personnel.

The second part of the project makes use of an airborne mounted methane detection and mapping system that has been used to look for both man made and naturally occurring methane sources in California. This system was built by JPL and used in various studies by the California Energy Commission as well as the California Air Resources Board. Limited use of this technology on aircraft has been done in California using JPL instruments, software and personnel. The information on existing methane sources is being gathered to develop a base line of methane emission sources and their locations throughout the State. The use of the system, software and personnel in a post-earthquake environment is not an activity sponsored by either the California Energy Commission or the California Air Resources Board. The purpose of this project is to identify stakeholders interested in obtaining post-earthquake methane concentrations in the area affected by a damaging earthquake for use by emergency responders and planners in mitigating fires related to earthquakes and helping locate leaks in rural areas.

The project budget \$438,271. The period of performance is one year from the start of the project. The project is in contracting negotiations and is anticipated to start in 2018.

Independent Peer Review Panel for Diablo Canyon Nuclear Power Plant

The SSC with many other state organizations, assisted the California Energy Commission in the development of a report in response to AB 1632 (Blakeslee) in 2008. The legislation directed PG&E to use advanced 3-dimensional seismic surveying and other methods to try to reduce the uncertainty in information regarding the plant's seismic hazard. In 2011 The California Public Utilities Commission created an Independent Peer Review Panel (IPRP) consisting of the California Public Utilities Commission (CPUC), the SSC, the California Geological Survey, The California Energy Commission, The California Coastal Commission and a representative from the County of San Louis Obispo. The IPRP has been reviewing and meeting as warranted with personnel from the Pacific Gas and Electric Company and various interveners since 2011. The IPRP has been focused on reviewing seismic hazards with respect to the Diablo Canyon Nuclear Power Plant since the shutdown of the San Onofre Nuclear Generating Station.

In December 2016, the SSC received a copy of a letter from the Nuclear Regulatory Commission (NRC). SSC staff requested additional information regarding the Diablo Canyon Nuclear Power Plant seismic hazard assessment. The CPUC has extended the IPRP until August of 2025. The IPRP periodically reviews documents from both the NRC and PG&E.

Inspection of Earthquake and Fire Damaged Buildings using Unmanned Aerial Vehicles (UAV)

A six-story light gauge steel building was constructed on the University of California's Outdoor shake table. The table was subjected to multiple earthquake shaking and fire tests. A third objective was added to this project that will ultimately lead to faster and more accurate inspection of earthquake damaged structures.

UAV imaging techniques were used to provide up-close, real-time data before, during and after the shaking and fire tests. Information gathered via UAV can benefit stakeholders, engineers, incident commanders and first responders, while increasing public safety. For this project, small, lightweight, multi-rotor UAVs were deployed to first carry out a complete, semi-autonomous site survey mapping to create a 3D model of the building, and for subsequent fire tests, record the thermal envelop (heat-map) of the entire building.

The project objectives were the following:

- study and test field deployable UAVs
- study communication techniques and protocols for UAV data transmission
- identify how UAV data may enhance situation awareness
- explore how to apply and implement the data products
- study how 3D models developed can support the inspection of damaged buildings

The results of this study could lead to post-disaster field teams having the ability to inspect damage, by capturing site-specific data from a broad range of perspectives. This data can be streamed to field centers, where it is processed into a 3D model that can be broadly shared with other stakeholders for analysis. UAVs operating semi or fully autonomously, continuously collecting data suitable to detect and assess short and long-term deterioration, measuring damage and observing structural weaknesses, faster, cheaper and safer than possible with existing techniques could be invaluable in helping damaged communities recover more rapidly.

This project was completed in the spring of 2017.

Explaining the Seismic Performance Presented in the California Building Code

One of the challenges in the earthquake policy field is bridging the public's expectation of the intent of the California Building Code seismic provisions with respect to building performance. In other words, what might a building look like after an earthquake if the building were designed to the current code? What might an existing older building that was retrofitted to code look like after an earthquake?

The SSC is funding the Pacific Earthquake Engineering Research Center (PEER) to create an educational document targeted to the general public. The final product will be a concise, clear and focused final report, along with an electronic file of a single sheet, double-sided, color info-graphic handout suitable for dissemination to the public.

The intent of this educational document is not to develop a compendium of all information known about the California Building Code, but specific findings related to the objectives identified above. Details will be provided in appendices to the report and by reference to other sources of information.

PEER will work cooperatively with a variety of organizations, companies and governmental entities to synthesize and analyze results obtained regarding the expectations of seismic behavior of buildings and their contents, when designed to the provisions of the current California Building Code. Topic areas that will be studied include earthquake effects on the built environment when designed to the current Building Code, and a general discussion of socio-economic impacts and expectations.

This project will be completed in the late spring of 2018.

Earthquake and fire performance of a mid-rise cold formed steel (CFS) framed building

A substantial growth in the use of cold-formed steel framed construction has recently been observed in high seismic regions of the western United States. Structural systems of this kind consist of light-gauge framing members (e.g., studs, tracks, joists) attached with sheathing materials (e.g., wood, sheet steel). While these lightweight systems provide the potential to support the need for resilient and sustainable housing, the state of understanding regarding their structural behavior in response to earthquakes remains relatively limited.

To better understand the performance of this type of construction, the SSC partnered with the University of California, San Diego, the Worcester Polytechnic Institute, the

Department of Housing and Urban Development, and more than fifteen industry partners.

The centerpiece of this project involved full-scale earthquake and fire testing of a full six story CFS wall braced building. The test building was constructed on the world's largest outdoor shake table—the Large High Performance Outdoor Shake Table at UC San Diego.

Earthquake motions were scaled to represent different levels of shaking on the test building. Subsequently, live fire tests were conducted on the earthquake-damaged building at two select floors.

Data gathered from this project will eventually be incorporated into building codes that will help ensure that buildings using this type of structural system will better survive earthquakes and hopefully help speed economic recovery.

This project was completed in the spring of 2017.

Post-Earthquake Business Recovery: Learning from Japan's Experiences

Japan and California have close economic and political ties. Japan is a major trading partner and many Japanese companies are in California. A major disaster that impacts one partner will have economic impacts on the other.

Japan has experienced many major earthquakes and has recovered rapidly from everyone. The SSC wanted to identify economic recovery policies the Japanese have implemented and apply them after major earthquakes in California. The SSC has funded a project with San Jose State University to:

1. Survey and review post-disaster economic recovery measures, following the March 11, 2011 Great East Japan Earthquake and Tsunami, implemented by Japanese governments (national, prefectural, and local), and where possible assess the extent to which these measures were effective.
2. Develop and deliver seminars to Japanese companies in northern and southern California to educate them on the earthquake threat in California, including pertinent regulations designed to accelerate economic recovery and limitations to the extent US federal, state and local governments can assist specific businesses.

3. Develop and implement a survey of Japanese companies to determine their perceptions of needs in a post-earthquake environment to accelerate their recovery. This will serve as the basis for the development of a more broadly applicable business/economic recovery strategy for the State of California.

4. Complete a final report to the SSC that will identify the most successful economic recovery policies implemented in post-earthquake Japan. Based on the results of this study, the SSC will consider a possible Phase II project that will incorporate existing policy recommendations gathered by the Commission and combine them with those implemented in Japan. This list could then be circulated among California businesses and industry with a request to identify those that may be most impactful on helping them recover after future major disasters in California.

Major Activities during 2017 included:

1. Initiated a review of published sources for information in English on post-disaster economic recovery incentives in Japan, especially those following the March 11, 2011 earthquake, tsunami and nuclear disaster.
2. Established contact with Japan Business Association (JBA) covering Southern California and the Japan Chamber of Commerce of Northern California (JCCNC). Met with representatives of JBA and JCCNC, and the Consul Generals of Japan in San Francisco and in Los Angeles, respectively, and successfully obtained commitment of cooperation and support.
3. Developed a PowerPoint presentation for Japanese companies in California, to educate them on earthquake risk in California and also California legislation that relates to earthquake safety and earthquake hazard mitigation. This material was presented to a gathering of JPA members. JCCNC in the process of arranging a meeting for this presentation.
4. Held meetings in Japan with national, prefectural and local governments to determine what, if any, incentives they have developed to foster economic recovery and growth.

This project will be completed in mid to late 2018.

Local Government Guidebook for Managing Risk of Collapse-Prone Buildings in California

California's 14 million buildings include some of the most modern and earthquake-resistant in the world. However, older buildings could be damaged and a few – perhaps less than 5% - could collapse in severe shaking. This amount may seem small, but collapse can cause significant life loss, injuries and substantial social and economic disruption mounting to hundreds of billions of dollars. The “Guide to Identify & Manage

Seismic Risks of Collapse-Prone Buildings” summarizes California’s laws and regulations to help local governments identify and reduce collapse risks, as well as best practices that building owners can take to manage the risks.

The SSC published this Guide and a companion Appendix in March 2017.

Review of Project Delays for the San Francisco Public Utilities Water System Improvement Program

The Wholesale Regional Water System Security and Reliability Act required the County San Francisco Public Utilities Commission to adopt a specified program of capital improvement projects designed to restore and improve the Bay Area regional water system that delivers water from the Hetch Hetchy Reservoir in Yosemite. Within 90 days of receiving a notice of project deletions or delays for the program, the SSC and the State Department of Public Health are to submit to the Joint Legislative Audit Committee written comments with regard to the significance of the changes with respect to public health and safety. In September 2017, the SSC received a notice about 15 months of delay for three projects and submitted its comments to the Joint Legislative Audit Committee in November. The delays don’t adversely impact the seismic safety of the program since the three projects experiencing further delays are not impeding the delivery of water.

Homeowner’s Guide to Earthquake Safety Update

The Homeowner’s Guide to Earthquake Safety is required by state law to be given to buyers along with forms filled out by sellers that disclose typical earthquake vulnerabilities in homes. First published in 1992 and last updated in 2005, the Commission is embarking on an update. A subcommittee chaired by Commissioner Cindy Silva along with Commissioners Ivan Wong and Randy Goodwin are leading this effort. They expect to convert the guide to color, reduce its length, and improve its readability.

Small Business Development (SBDC) Continuity Training: Earthquake Education/Outreach Project Phase II

The California SBDC Network was awarded \$220,000 to create educational modules regarding disaster preparedness for new and existing business owners. The educational modules encompassed information that small business owners need to know to be prepared for disruption caused by major earthquakes or other natural disasters.

The California SBDC Network provides (2) direct service delivery methods for educating small business owners. The two services are one-on-one consulting and training. Consulting is provided at a no-cost basis and trainings are provided at little to not cost. The California SBDC Network created new educational curriculum for small business owners through a five-minute instructional video on disaster preparedness and awareness and handout materials. Small business owners received such curriculum through training and then those seeking further assistance on how to create disaster preparedness plans were consulted one-on-one for specialized assistance.

California SBDC Network committed to conduct 420 trainings across the state, educating approximately 10,500 individuals. The California SBDC Network conducted 859 trainings across the state, training 10,647 individuals. The trainings were rolled out a little more than a year ago and all 43 SBDC centers participated in the program.

More than 10,500 individual businesses were introduced to disaster preparedness for their business.

This project was completed in Winter 2017

HayWired: How Earthquake Damage Communication and Information Technology in the Bay Area

The United States Geological Service (USGS) and Joint Venture Silicon Valley partnered with the SSC to research and strategize to enhance the resilience of Bay Area communities to Climate Change and Natural Hazards. The USGS in collaboration with its partners and stakeholders transform hazard information into risk products that are useful for decision and policy makers across scales of government and the private sectors.

Currently, the USGS is leading a scenario, called HayWired, in the San Francisco Bay Area of California. The HayWired scenario is a hypothetical, but realistic earthquake sequence initiating with a rupture of the Hayward Fault. The main earthquake is a magnitude 7.0 with hypocenter in Oakland, California. HayWired is a reference to the Hayward Fault and speaks to the potential chaos caused by impacts to the wired and wireless world. More generally “wired” represents interconnectedness at many levels: interdependencies of lifeline, social connectivity through technology, and the ripple effects of damages and disruption encompassing the digital economy. The HayWired theme is particularly apropos for the Bay Area, a leader in digital communications and technology.

The HayWired scenario addresses risks of climate change and natural hazards, benefiting communities, businesses, governmental agencies and the general public in the Bay Area, California.

The HayWired project is slated to be released in the spring of 2018

Community & Media Outreach

The SSC has developed and financially supported a wide range of methods, technologies and practices for preparedness, response and recovery. SSC's efforts range from scientific, construction related, and consistent with general preparedness information for not only the people of California but worldwide. The SSC website and social media outlets and relationships with other state entities including California Governors of Emergency Services (CalOES), California Earthquake Authority (CEA), Non-Governmental Organization, such as the Red Cross, Tribal organizations, and state-wide associations, such as the California State Association of Counties and League of Cities, and other respective organizations. Regents of the University of California San Diego Principal Investigator will create communications plan which will elevate SSC's mission and produce easily find digestible and engaging information surrounding earthquake preparedness. This communications plan will create a hub of resources and information about the SSC assisting the residents of the state in becoming better aware of the risks of and prepare for earthquakes.

The goals and objectives of this effort are increased public awareness of the need for, engagement with and community practice in earthquake preparedness and disaster response in California. This will be achieved by creating and then leveraging a network of services and media partners to highlight efforts supported and enabled by the SSC. The effort will also significantly expand the number and quality of channels and media types used to communicate information and build ongoing public awareness of the importance of preparedness, effective response and resources available.

By enhancing the impact of the SSC's work, the Principal Investigator will undertake research into what media outlets look for and prepare and execute a media plan including traditional and social media. The goal of the work is to increase the earthquake awareness and preparedness of the residents of California, both directly and through their civic leaders and the media. The contractor will utilize various direct and indirect channels to communicate the efforts and achievements of the SSC and amplify the work of its partners.

This project is to be completed in Spring of 2018

HayWired Scenario/ Branding, Marketing and Public Engagement Campaign

This campaign will build awareness about the HayWired scenario and report findings. SSC has hired the Honey Agency to develop a consumer-friendly platform and campaign to inform target audiences on proactive earthquake preparedness, loss mitigation and how to recover rapidly from earthquakes. Building awareness about the HayWired scenario and the findings that are published in the various reports, the Honey Agency will create a recognizable and unique brand for the scenario. The deliverables include creating a toolkit of materials, a website, brochures, flyers, social media graphics and media/press kit and badge for the project's partners and participating businesses.

The key tasks identified in this contract will set a strong foundation for outreach to businesses, local government and the strategy for a future Phase II, which is a state wide public engagement campaign, resiliency challenge and mitigation to the project's steady to state.

This project is to be completed 2018