



June 24, 2022

Toni Akins, Senate President pro Tempore
Anthony Rendon, Speaker of the Assembly
California State Capitol
Sacramento CA 95814

Subject: AB 100 Annual Report

Dear Senate President pro Tempore Akins and Speaker Rendon,

The Alfred E. Alquist 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. The SSC investigates earthquake-related issues and evaluates and recommends to the Governor and Legislature policies and programs needed to reduce earthquake risk.

Assembly Bill 100 (Committee on Budget) enacted as Chapter 20 of the Statutes of 2020, established an annual reporting requirement of the SSC. AB100 recognized that numerous agencies at various levels of government have substantial responsibilities in the fields of earthquake preparedness and seismic safety. Through these annual reports the SSC can assist in providing a consistent policy framework to track and monitor these activities, work with specific state departments as well as various stakeholders on findings, progress, and recommendations that will highlight higher levels of seismic safety and other seismic safety issues. These annual reports will be submitted to the Governor and State Legislature, along with periodically updates by these entities to the SSC, through Commission hearings.

Through examination of existing partnerships, in 2021 the SSC Executive leadership team requested reports from the California Geological Survey and the California Department of Health Care Access and Information, formally known as the Office of Statewide Health Planning and Development. These reports highlighted the seismic programs and products of the respective organizations and included a description of the value of the program(s) and product(s) to the public, State, local government, businesses, and other entities.



Seismic Safety Commission

June 24, 2022

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These reports also identify long term goals for the organization's seismic program(s). Attached, is the California Geological Survey's report *California Geological Survey Contributions to Earthquake Preparedness* and the California Health Care Access and Information's report *HCAI's Seismic Compliance Program and Product Report*.

Should you have any questions please contact Reggie Salvador at Reggie.Salvador@caloes.ca.gov or 916-845-8473.

Sincerely,

Salina M. Valencia

Salina M. Valencia

California Seismic Safety Commission, Acting Executive Director

Attachments:

Attachment A: California Geological Survey Contributions to Earthquake Preparedness and Safety

Attachment B: Health Care and Access Information Seismic Compliance Program and Product Report

c: Mark S. Ghilarducci, Director, Governor's Office of Emergency Services



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August 31, 2021

To: California Seismic Safety Commission

The Hospital Building Safety Board (HBSB, or “Board”) was established by Senate Bill 519 (Alquist, Chapter 1130, Statutes of 1972) 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 Department of Health Care Access and Information (HCAI), formerly 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.

The Director of HCA 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 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.

A handwritten signature in black ink that reads 'Ken Yu'.

Ken Yu
Executive Director
Hospital Building Safety Board

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HCAI's Seismic Compliance Program and Products

August 31, 2021

Purpose and Objectives

A key function of the Department of Health Care Access and Information (HCAI), (formerly known as the Office of Statewide Health Planning and Development or OSHPD) is to enforce the Alfred E. Alquist Hospital Facilities Seismic Safety Act of 1973 (HSSA or the Act).

On February 9, 1971, a 6.6 magnitude earthquake struck the San Fernando Valley region of Los Angeles County near Sylmar, killing 64 people and costing over \$500 million in damages. Two hospitals collapsed and nearly all of those killed in the Sylmar earthquake were either patients or employees in those hospital buildings.

The loss of life incurred due to the collapse of hospitals in the 1971 Sylmar Earthquake resulted in the Legislature enacting the HSSA. Specifically, Senate Bill (SB) 519 (Alquist, Chapter 1130, Statutes of 1972) established a seismic safety building standards program under HCAI's jurisdiction for hospitals built on or after March 7, 1973. The Act emphasized that essential facilities, such as hospitals, should remain operational after an earthquake.

The Act required buildings to have special seismic detailing to resist earthquake forces with limited damage. Since March 7, 1973, the design, construction, and maintenance of California's hospitals have been governed by individual statutes, regulations, and design standards aimed at assuring hospital functionality following a major earthquake. The standards are intended to ensure that all patients are safe in an earthquake and the facilities remain functional to care for injured persons in the community after such a disaster. These standards are implemented by HCAI and include stringent seismic design requirements, thorough plan review, approval of all designs, continuous construction inspection, materials testing, and strict monitoring of all construction projects.

It is the intent of the HSSA that hospital buildings that by definition house patients who are sick or injured, and that must be reasonably capable of providing services to the public after a disaster, shall be designed and constructed to resist, insofar as practical, the forces generated by earthquakes, gravity, and winds.

However, the HSSA, passed in 1973, only applied to new hospital buildings and the alterations or remodeling of existing structures. HCAI had no authority to require upgrading of pre-HSSA structures to meet the mandated standards for new construction. When the Act became law, it was envisioned that these pre-1973 Act or nonconforming buildings would be replaced with new conforming buildings through

attrition. However, years later, a significant number of nonconforming hospital buildings with questionable earthquake performance were still in use.

The HSSA was amended in 1983 to preempt the local building department jurisdictions for hospital construction plan review and observation.

Almost 23 years after the enactment of the HSSA, in the early morning hours of January 17, 1993, another deadly earthquake hit the San Fernando Valley, this time centered in Northridge. Although the 6.7 magnitude earthquake caused 57 fatalities and up to \$20 billion in damage costs, hospitals built in accordance with the standards of the Act survived the Northridge earthquake with minimal structural damage, while several hospitals built prior to the Act sustained major structural damage and had to be evacuated. However, some nonstructural components of the hospitals did incur damage, even in facilities that were built in accordance with the Act.

Eight months after the Northridge earthquake, SB 1953 (Alquist, Chapter 740, 1994) was signed into law, amending the Act to address issues of the survivability of both structural and nonstructural components of hospital buildings after seismic events. SB 1953 required General Acute Care hospital buildings that are not only capable of remaining intact, but also capable of remaining functional insofar as practicable and providing acute care services after a seismic event, the ultimate goal of the Act.

Services, Mandates and Activities, etc.

The HSSA authorized HCAI and bestowed the responsibilities to implement the following programs and services. (1) Promulgation of Building Codes and Standards, (2) Plan Reviews and Building Permits, (3) Pre-approvals program, (4) Construction Observation, (5) Hospital Inspector of Record Certification Program, (6) Hospital Seismic Compliance Program, (7) Research, and (8) Emergency Response.

Hospital Seismic Compliance Program

The Hospital Seismic Compliance Program established by SB 1953 following the 1994 Northridge Earthquake required all acute care hospital buildings to be evaluated for seismic compliance and it was based on a two-step approach: (1) Buildings that provided acute care services and posed a significant risk of collapse during an earthquake had to be removed from service by 2008 or strengthened to a higher level of seismic performance. (2) All acute care hospital buildings, by January 1, 2030 must be capable of not only surviving a major earthquake, but also must be capable of providing on-going services after the earthquake. As such, buildings grandfathered under the HSSA that do not pose a significant risk of collapse are allowed to remain in acute care service until 2030. These buildings are not expected to be functional after a seismic event.

Seismic Evaluation

The seismic evaluation procedure regulations consist of eleven articles (California Administrative Code, Part 1, Chapter 6) and their primary purpose was to evaluate the potential earthquake performance of a building including its components and place it into specified seismic performance categories. The procedures were developed with experience gained in evaluating and seismically retrofitting deficient buildings in areas of high seismicity.

Seismic Performance Categories (SPCs)

One of the main provisions of SB 1953 is the development of earthquake, or seismic, performance categories, Structural Performance Categories (SPC) and Nonstructural Performance Categories (NPC) . These include seismic performance categories for new and existing general acute care hospitals facilities in various sub-gradations, from those capable of providing services to the public after a seismic event (SPC 5/NPC 5), to those at significant risk of collapse and that represent a danger to the public (SPC 1/NPC 1). Each facility receives both an SPC and NPC rating, and both seismic performance categories considered when determining a facility's compliance with the provisions of the Act.

Seismic Retrofit Regulations

The seismic retrofit regulations apply to all existing general acute care hospital buildings. The goal of these regulations is to develop retrofit and repair designs for existing hospital buildings to yield predictable seismic performance, whether at the essential, life safety level or the post-earthquake, functionality level. The requirements of seismic retrofit regulations must be used to upgrade from an existing seismic performance category to a higher category level. Specifically, these regulations were explicitly developed for use in the retrofit, repair, modification, or alteration of existing hospital buildings.

Specified Timeframes for SPCs

Each general acute care hospital building must be at certain seismic performance category levels by specified timeframes. For example, in the initial law, all general acute care hospital facility buildings at significant risk of collapse and that represent a danger to the public (SPC 1 level) had to be brought up to the SPC 2 Level ("Life Safety Level") by January 1, 2008 to be in compliance or removed from acute care services but provisions were made to allow this deadline to be extended to January 1, 2013, if compliance with the 2008 deadline would have resulted in a diminished capacity of healthcare services to the community. There were several legislative efforts to modify the original compliance deadline, which had already been extended to 2013. Eventually, the 2008 compliance deadline was moved to 2025. Timeframes for the submittal of seismic evaluations, compliance plans, and other seismic performance levels are cited in the seismic evaluation procedure regulations.

Plan Review and Construction Observation

The HSSA was amended in 1983 to preempt the local building department jurisdictions for hospital construction plan review and observation. Upon receipt of construction documents (plans, construction specifications, etc.), each submittal is reviewed by HCAI Architects, Engineers, and Fire and Life Safety Officers to determine if the submittal is compliant with the requirements of the California Building Standards Code (CBSC) and the HSSA. After plan approval, the construction observation process involves the HCAI field compliance unit for health care facility construction oversight verifying that projects are compliant with the approved construction documents and the CBSC. This can be broken up into several steps beginning with building permit issuance to the issuance of a certificate of occupancy. Please refer to the links to HCAI's Seismic Program Websites section below for more detailed information on the Construction Observation Process.

Regulations Development

Hospitals (as defined in Section 129725 and licensed pursuant to subdivision (a) of Section 1250 of the Health & Safety Code) shall comply with the regulations developed by HCAI as mandated by HSSA. Consequently, HCAI is the authority having jurisdiction for hospitals and skilled nursing facilities (SNFs). This means that HCAI develops the regulations and building standards and enforces them for these occupancies. Building codes and standards must be submitted to the Building Standards Commission for public review and comment before they can be adopted and become enforceable. In August 2021, there are 418 general acute care hospital facilities, comprised of 3,153 hospital buildings, that are affected by the provisions of SB 1953. If a building is to remain a general acute care hospital building beyond the specified dates established by the Act, the owner must conduct seismic evaluations and prepare both a comprehensive evaluation report, and a compliance plan, to attain specified structural and nonstructural performance categories which must be submitted to HCAI.

Hospital Building Safety Board

The Hospital Building Safety Board (HBSB, or "Board") was established by SB 519 in the original 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 HCAI 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.

The Director of HCAI appoints sixteen Board members from nominations submitted by professional associations, as specified in the Act, and has the authority to appoint three more as 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.

The Board is comprised of seven committees which are made up of Board members and consulting members. Each committee meets several times per year, each with a set of goals to assist HCAI in administration of the Act. The work of the committees is overseen and approved by the Board at the Full Board meetings which occur three times per year. Please refer to the links to HCAI's Seismic Program Websites section below for more information on HBSB and its committees.

Research

The HSSA (Section 129680(d)) authorizes HCAI to conduct research regarding the reduction or elimination of seismic or other safety hazards in hospital buildings and research regarding hospital building standards. There has never been a greater emphasis on building science and technology than in the last three decades. Advances in building design methods, systems and materials occur every year. Consequently, through its inception HCAI/ has commissioned/involved and/or conducted earthquake engineering research to improve understanding of the behavior and potential for damage of building structures under the forces generated and imposed by catastrophic earthquakes. As a result of this understanding, building codes, design and construction practices can be modified so that future earthquake damage is minimized and the objectives of the HSSA are fully met – functional hospital buildings in the aftermath of catastrophic earthquakes. Some recent examples are (1) Simulation of the seismic performance of nonstructural systems, Nonstructural Grand Challenge - University of Nevada, Reno sponsored by the National Science Foundation, (2) Seismic Response of a 5-Story Building Equipped with Nonstructural Components, etc.

Emergency Response

When a significant disaster occurs, the HCAI Emergency Response Plan and the HCAI Emergency Operation Center (EOC) are activated by the HCAI Director or other authorized staff in concert with California Department of Public Health (CDPH), Emergency Medical Services Authority (EMSA) and Office of Emergency Services (OES). In such an event, HCAI is mandated to respond as follows:

- Provide emergency structural, critical nonstructural, and fire and life safety assessment of acute care hospitals and skilled nursing facilities.
- Ensure rapid inspection postings of facilities in HCAI jurisdictions in a disaster area.
- Provide information on HCAI's emergency assessment status of facilities to CDPH, EMSA, OES and others as necessary.

- Arrange priority review, approval, and permitting of hospital repair and reconstruction of those affected facilities for a limited time period following a disaster.

Upon activation, HCAI's EOC is set up in HCAI's Sacramento or Los Angeles offices in accordance with the Standardized Emergency Management System, to manage and coordinate the emergency response (a forward staging area may also be established). Priorities for inspection are established by HCAI in cooperation with CDPH, EMSA, OES and the affected facilities.

The HCAI Emergency Response Plan is based on the following emergency response policies:

- HCAI is tasked in the California State Emergency Plan to provide assistance in two emergency response areas: 1) the Medical and Health Services Function, and 2) the Construction and Engineering Function. HCAI's priority is to assist EMSA with implementation of the Medical and Health Function response. Assistance to the Construction and Engineering Function is secondary and provided only if personnel and resources are available.
- HCAI's primary directive is to maintain occupancy for hospitals and skilled nursing facilities as long it is safe to do so. Consideration is given to potential damage from earthquake aftershocks.

Long Term Goals of HCAI's Seismic Programs

- Incorporate the latest science and engineering into the building codes so that new hospital buildings contribute to high degree to community resiliency.
- Research seismic response and damage through instrumentation of hospital buildings.
- Provide a framework where existing hospitals in California are continuously improved to be remain capable of functionality after a large seismic event.

HCAI's Seismic Program and the Value to the State of California

California recognized the vital role that hospitals have in our society more than five decades ago, after the Sylmar Earthquake, when it adopted the HSSA. This law requires hospitals to be constructed to higher standards than other buildings. After the Northridge Earthquake in 1994, California realized that more was needed to make its hospitals seismically safe. As a result, California re-emphasized its commitment to hospital seismic safety with the enactment of SB 1953 in 1995.

The need for functioning hospitals after a major earthquake is obvious and rarely disputed. While emergency field hospitals, medical tents, and air-lifts to available

facilities are often used to supplement for damaged hospitals, they will never provide a sufficient substitute. Only modern health care facilities located within the damaged region and capable of functioning can adequately provide the needed medical assistance.

Hospitals are a beacon of life and hope for a community. Through their unique role in a society's survival capability hospitals are the first place that the public turns to in the event of a wildfire, terrorist attack, earthquake or some other natural disaster for emergency care. It is crucial that hospitals remain standing and functional during one of these events for the safety of patients and staff to provide medical care to victims. If these buildings are damaged so that they cannot function, society remains vulnerable.

In an article entitled "When Hospitals Fall Victim to Disaster," a reporter made the following observation after the catastrophic flooding in Iowa in 1998 regarding the role of hospitals after a disaster, "The epic floods in Iowa led to the evacuation of nearly 200 patients from Mercy Medical Center in Cedar Rapids... One of the things we've seen is people accept that disasters are going to happen, but hospitals are held to a different standard. There's a saying that "the last light on is always at the hospital." It's a physical, caring environment and a beacon of hope. I've got to imagine there's just a real emotional toll on the community to have a beacon in the community to have to shut down because the disaster is so severe."

This phenomenon was witnessed after the Northridge Earthquake in 1994. Emergency responders and inspectors arrived at hospitals in the affected area only to find hundreds of people congregated in hospital waiting rooms, parking lots and the surrounding vicinity seeking medical help or just wanting to learn the fate of family members or neighbors. In this manner hospitals play an important societal role for survivors as well as the injured, immediately following a disaster.

Without functioning hospitals, it takes much longer for a community to recover from a disaster. Vital services have to be in place before a community can get on about the business of recovery and normalcy of life again. Prolonged recovery seriously delays the area's economic and social renewal. Hospitals are often the largest employer in a community and the loss of the hospital may result in the closure of many other businesses in the community. Thus, an economic disaster follows on the heels of the natural disaster, compounding and extending the recovery efforts to where local recovery may take decades, if achievable at all.

Because the evacuation of seriously ill patients can be detrimental and sometimes fatal, hospitals cannot be evacuated like other buildings, making it imperative that they survive earthquakes intact. Replacing a heavily damaged hospital building can often take years, depriving the community of sorely needed healthcare resources.

Budget Information

The Hospital Building Fund (HBF or Fund 0121) is administered by HCAI and is the funding source of all of HCAI's seismic programs. HCAI began Fiscal Year (FY) 2020-21 with an operating budget appropriation of \$68.3 million that includes funding for FDD and the administrative divisions that provide support to the seismic program. Due to the COVID-19 emergency, the state anticipated significant economic impacts and a decrease in revenue for all funding sources including the HBF. State agencies were required to take steps to reduce their operating expenditures, be more efficient, and to be mindful of non-essential purchases. HCAI staff identified operating savings and were able to reduce the department's FY 2020-21 seismic program operating budget to from \$68.3 million to \$64.2 million. In Fiscal Year 2021-22, HCAI's seismic program operating budget is approximately \$69.8 million.

Links to HCAI's Seismic Program Websites

Seismic Compliance and Safety: <https://HCAI.ca.gov/construction-finance/seismic-compliance-and-safety/>

Building Permits & Construction Observation: <https://HCAI.ca.gov/wp-content/uploads/2020/10/Additional-Information-FDD-Construction-Observation-Process.pdf>

Hospital Building Safety Board: <https://HCAI.ca.gov/construction-finance/hbsb/>

Making California Safer – California Geological Survey Contributions to Earthquake Preparedness and Safety

Digital Accessibility Statement: If you find any part of this document to be inaccessible with assistive technology, visit our [Accessibility web page at conservation.ca.gov](https://www.conservation.ca.gov) to report the issue and request alternative means of access. To help us respond to your concern, please include the following three items in your request: 1. your contact information. 2. the title of this document. 3. the web address where you obtained the document.

The [California Geological Survey](https://www.conservation.ca.gov) (CGS) provides scientific products and services about the state's geology, seismology, and mineral resources, including their related hazards, that affect the health, safety, and business interests of Californians. The CGS operates programs in five main areas: Mineral Resources and Mineral Hazards, Forest and Watershed Geology, Regional Geologic and Landslide Mapping, Seismic Hazards, and Strong Motion Instrumentation.

The CGS contributes directly to the earthquake safety of Californians through its scientific work on hazards mapping, identification of earthquake faults and surface ruptures, and by monitoring and reporting on all earthquakes in the state.

The CGS Seismic Hazards Program (SHP) creates maps that identify specific areas known to be vulnerable to earthquake hazards such as surface fault rupture, soil liquefaction, landslides, and tsunami inundation. These maps and services are utilized in pre-development planning at the local level, with the aim of building communities that are more resilient to seismic hazards. The program also conducts site evaluations for every proposed school and hospital in the state to assess the sites for seismic and geologic hazards.

Through its Strong Motion Instrumentation Program (SMIP), the CGS installs and monitors seismic instruments on buildings, dams, bridges, hospitals, and other structures to analyze ground motion during earthquakes and to examine the response of these structures to ground shaking. The data collected by the program are shared and utilized by the larger seismic community to reassess building codes and improve structural seismic design practice, thereby protecting citizens and property from hazards and economic loss.

SMIP cooperates with other seismic networks to produce ShakeMaps, which are distributed to emergency management and response teams within 5-7 minutes of an earthquake to assist with immediate emergency responses in areas suffering damage. Also in coordination with other agencies, SMIP is working to develop an earthquake early warning system, which would provide Californians with advance warning of strong shaking when an earthquake occurs.

The CGS Regional Geologic and Landslide Mapping Program (RGLMP) conducts detailed geologic mapping of the state, showing geologic structures, fault locations, landslides, and unstable soils. This information is essential for the construction of earthquake-resilient housing, buildings, and essential infrastructure such as bridges, dams, water conveyance and treatment facilities, and fire and police stations. RGLMP mapping also produces landslide inventories and data that assist in planning for long-term landslide hazard mitigation by developers and planners throughout the state.

The California Geological Survey provides crucial and timely information, materials, and services to the Governor’s Office, the Legislature, state and local authorities, consultants, the business community, and individuals. These products are foundational to the quality of decision-making related to life and safety issues, the economy, and the well-being of communities.



The CGS is developing its first regulatory Tsunami Hazard Zone maps. Like existing hazard zone maps that show areas prone to surface rupture, landslides, and liquefaction, these new maps will require site-specific geotechnical studies to help communities minimize the tsunami hazard.

Sidebar

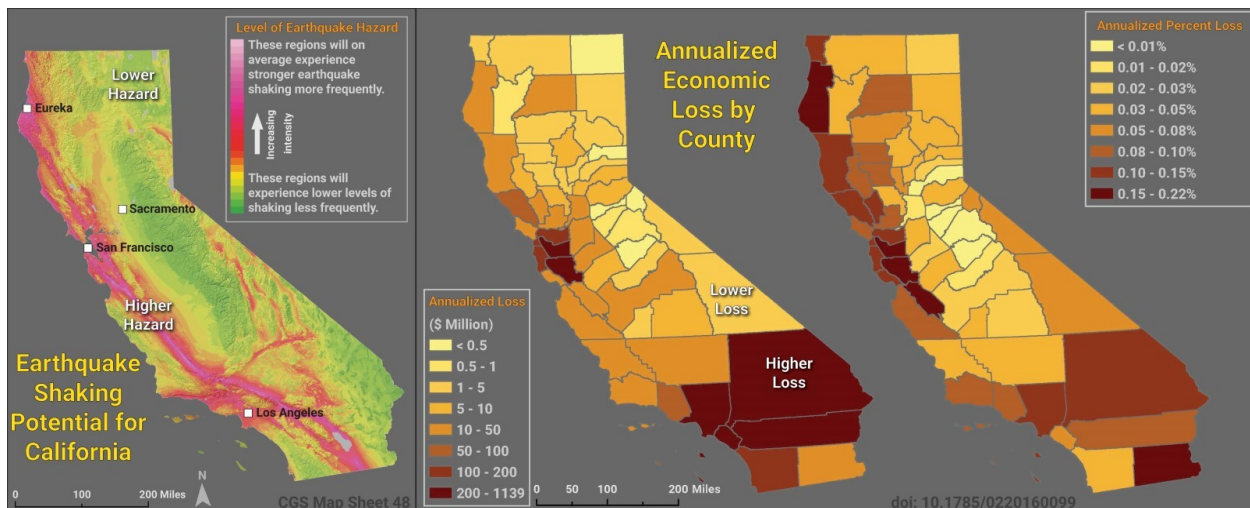
The California Geological Survey is one of the oldest geological surveys in the nation. Our mission is to provide scientific products and services about the state's geology, seismology, and minerals that affect the health, safety, and business interests of the people of California. "Altiora Petimus" (We Reach Higher)

Identifying, characterizing, and assessing the impact of earthquake-related hazards in the state

The CGS estimates [future earthquake shaking levels](#) and the [economic losses associated with earthquake shaking](#). The CGS maintains a [database of active earthquake faults](#), which is provided to the USGS and is used to forecast large seismic events in the state for emergency response planning (the [Uniform California Earthquake Rupture Forecast](#)). The [CGS Seismic Hazards Assessment unit](#) performs independent reviews of geotechnical and seismological reports prepared for other state agencies that oversee critical and essential-services facilities around the state. These [assessments include the review of school and hospital sites](#) for the Division of the State Architect and the Office of Statewide Health Planning and Development. These products and services assist in the development of earthquake-resilient structures, reducing both casualties and economic losses.

The CGS creates [Tsunami Hazard Area maps](#) for evacuation planning, [tsunami "playbook" products](#) to assist in local evacuation and maritime response activities, and Harbor Improvement Reports providing mitigation activities for county Local Hazard Mitigation Plans. These products help maritime communities reduce tsunami impacts on life-safety, infrastructure, and recovery.

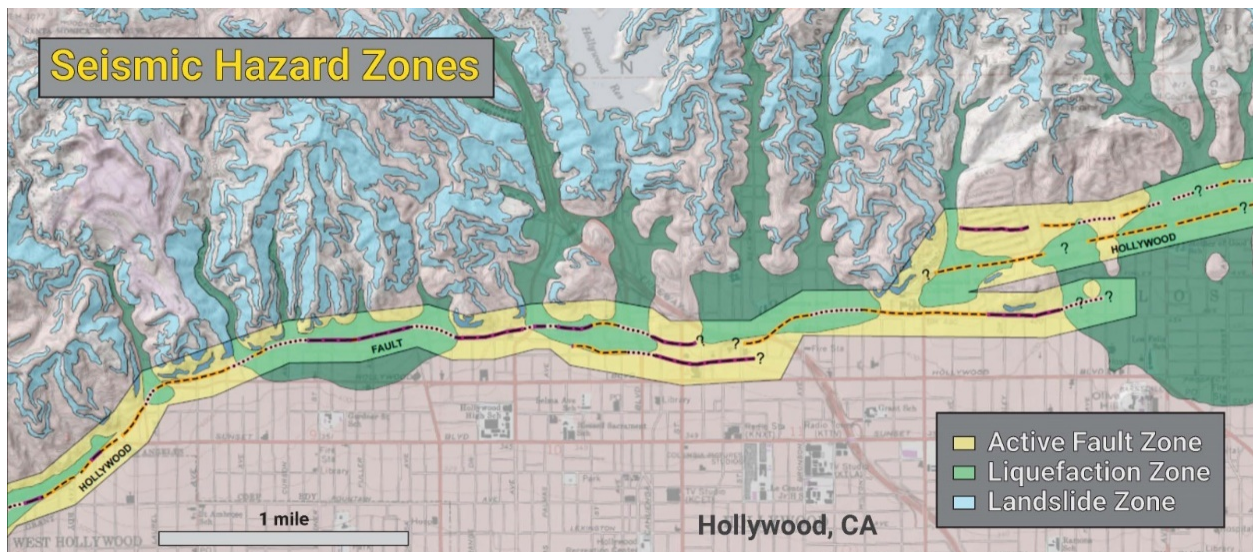
To support this earthquake hazard assessment program, the CGS plans to create a public-facing, statewide geological and geotechnical database and repository that agencies and consultants can access directly to upload, view, and download data and reports. This database will improve access to information and increase public awareness of earthquake hazards.



Earthquake Hazard Assessment. Shaking Potential and Shaking Loss Estimates (left: Annualized Economic Loss; right: Annual Percentage Loss).

The CGS delineates areas susceptible to various types of ground-failures during and after earthquakes such as [surface fault rupture](#), soil liquefaction, and [landslides](#). These hazard zones are discoverable via the [CGS “EQ Zapp”](#) where one can search an area and view a specific property's exposure to these hazards. Tsunami hazard zones will be added in late 2021. These regulatory zones, along with their associated [reports](#) and [guidance documents](#), provide the public and local governments with tools to mitigate hazards before the earthquake or [tsunami](#) occurs. These tools make communities more resilient to earthquakes, thereby reducing the costs and time of recovery. Analysis of the CGS Seismic Hazard Zone Mapping Project, submitted to FEMA, suggested that these regulatory zones have a 9 to 1 benefit-cost ratio.

Through the CGS Strategic Framework, the CGS plans to develop fully probabilistic and semi-automated seismic hazard zoning methodologies, so all seismic hazard zones are prepared statewide and updated regularly. This will lead to increased efficiencies, lower costs, and greater statewide consistency in hazard delineation.



Earthquake Hazard Zoning. Fault (yellow), Liquefaction (green), and Landslide (blue) Zones of Required Investigation near Hollywood.

Following significant seismic, tsunami, and volcanic events, as Chair of the [California Post-Earthquake Information Clearinghouse \(EQCH\)](#), the CGS provides real-time geoscience and engineering field intelligence to Federal and State Emergency Operation Centers, the State Geologist, the USGS, and the public. The [2019 Ridgecrest earthquake sequence](#) is the most recent example for which CGS personnel used the EQCH to document field observations of perishable features, evidence of the coseismic surface rupture, landsliding, and liquefaction.

The CGS provides real-time response to [tsunami](#) and volcanic events. For example, CGS geologists [documented observations of the 2011 East Japan tsunami](#) as it impacted the residents of and visitors to California. The Seismic Hazards Program also provides [earthquake-related](#) and [tsunami-related](#) information to local and regional governments,

the U.S. Coast Guard, [ports and harbors](#), professional organizations, and [science teachers](#), often in partnership with the USGS, the Earthquake Engineering Research Institute, the California Earthquake Alliance, the California Earthquake Authority, the Southern California Earthquake Center, and other NGOs.

The CGS plans to expand the earthquake emergency response program by improving the disaster response tools, protocols, and procedures for earthquakes, tsunamis, storm-driven landslides, and debris flows to prepare for geologic and coastal hazards. This will improve the seismic hazards products that the CGS provides to the public.

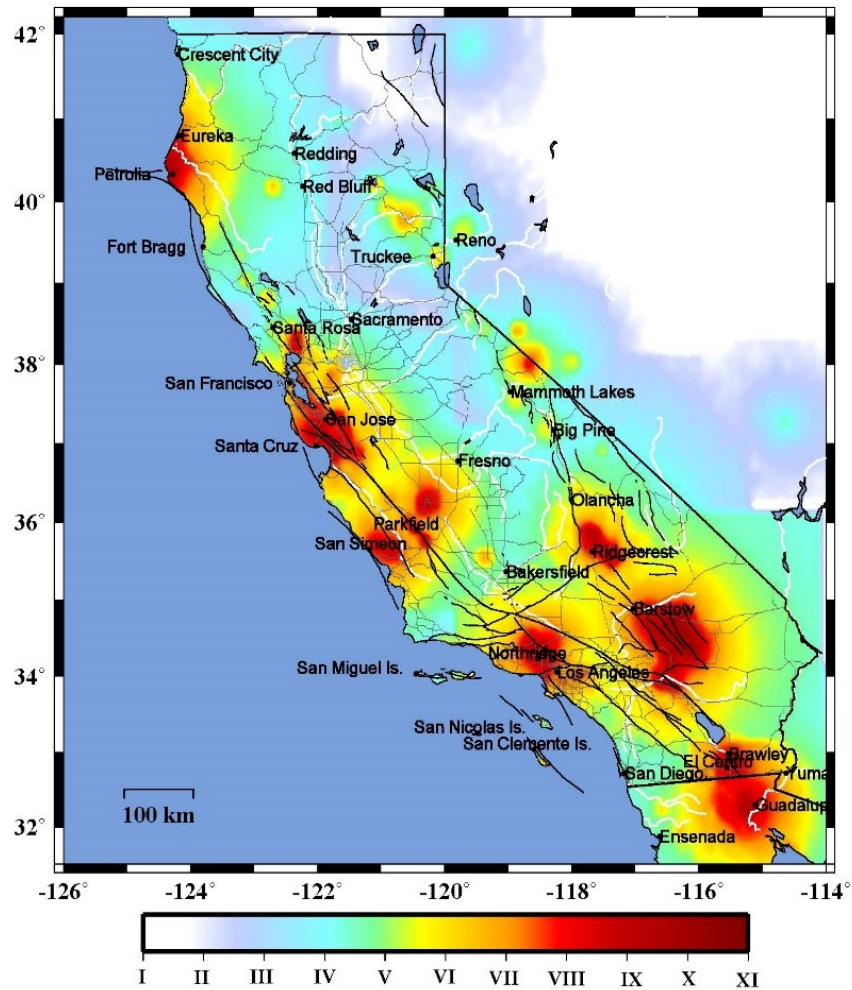


Earthquake Emergency Response. Top: Web-Based (left) and Physical (right) Clearinghouse. Bottom: 2019 Ridgecrest Earthquake Sequence fault rupture.

Constantly monitoring the seismic activity of the state for emergency response and long-term resilience of structures to earthquake shaking

The CGS operates one of the largest seismic networks in the world through its [Strong Motion Instrumentation Program \(SMIP\)](#). The network comprises over 1,360 stations and continues to grow each year as the CGS installs sensitive seismic monitoring instruments in the ground and in structures such as buildings, dams, bridges, wharves, and water conveyance facilities throughout California. In partnership with Caltrans, the

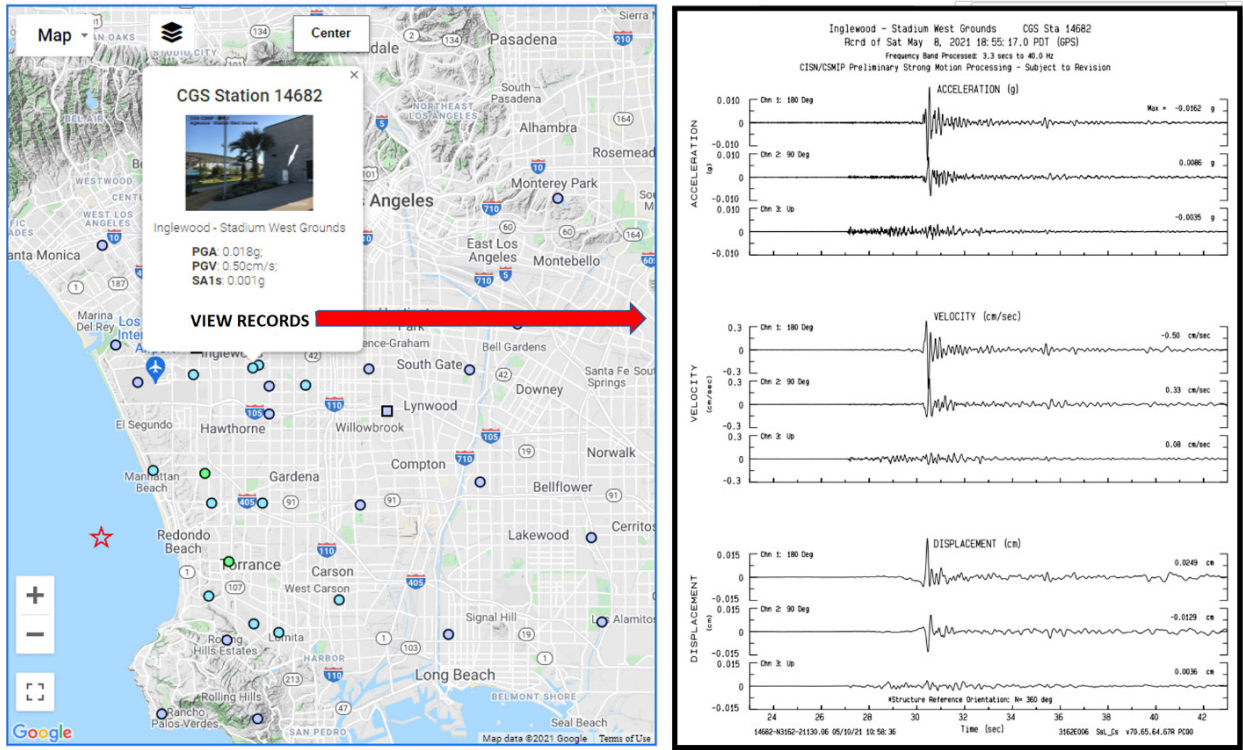
CGS has installed seismic instrumentation on approximately 84 bridges. In addition, over 250 buildings have been instrumented by the CGS. This includes 86 hospitals instrumented in partnership with the Office of Statewide Health Planning and Development. The goal in deploying these seismic monitoring instruments is to record the shaking response of the ground and structures to earthquakes. These recorded data can then be used to further our understanding of structural and ground motion phenomena, improve seismic design code provisions and design practices, and provide information to guide post-earthquake emergency response.



Maximum earthquake shaking intensity experienced from 1981-2020. Colors represent the shaking intensity on a scale of 1 (not felt) to 11 (extreme).

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[Back to IQR page for 3.5MLR Hermosa Beach Earthquake of 08 May 2021 18:55:40.440 PDT](#)

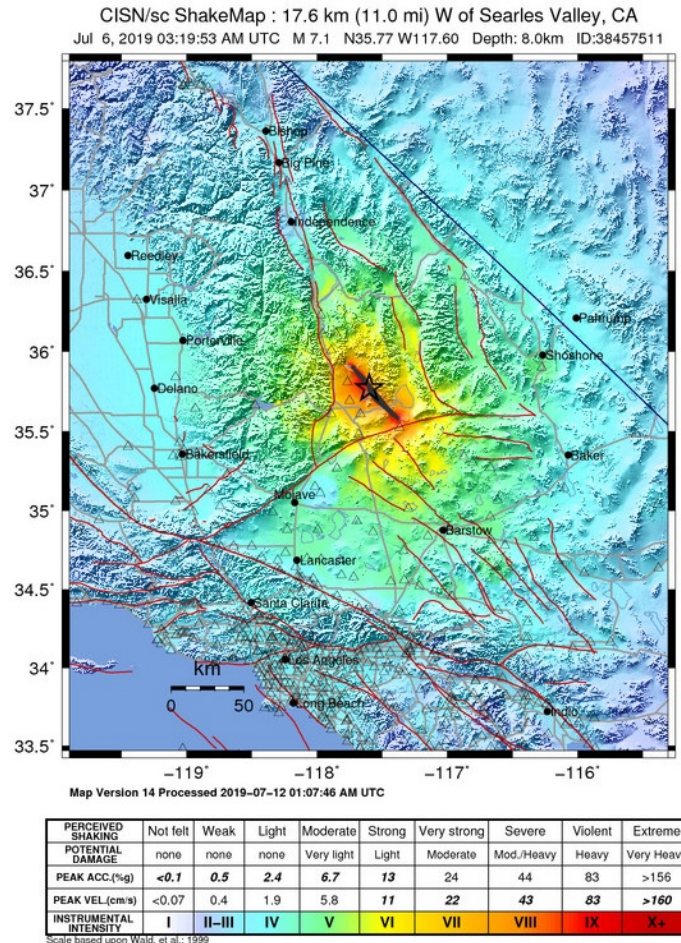


Example of earthquake records available at the CESMD website (CGS Station 14682). Records include acceleration, velocity, and displacement data.

In partnership with the USGS, the CGS created and operates the Center for Engineering Strong Motion Data (CESMD). The CESMD is the official repository of earthquake strong motion data recorded by the USGS and CGS both in California and around the world. These strong motion data are made accessible to the scientific and engineering communities at the CESMD website as soon as they are available. The data are used by researchers worldwide to study earthquakes and their effects on natural and built environments. Each year, the CGS sponsors research projects related to these topics, and the results have led to numerous improvements in the building code and seismic design practice, which have made communities safer and more resilient.

The CGS cooperates with the other seismic networks in California in a partnership called the California Integrated Seismic Network (CISN). The CISN is an effort that focuses on standardizing the collection of earthquake information in California, and it operates with sponsorship from the California Office of Emergency Services (CalOES). Other key partners in the CISN include UC Berkeley Seismic Laboratory, Caltech Seismic Laboratory, and the USGS.

The CISN records between 450 and 750 earthquakes per week in California, most of which are imperceptible to humans. The CISN produces maps showing the intensity and distribution of the ground shaking, called [ShakeMaps](#), within 5-7 minutes following an earthquake. The ShakeMaps are automatically distributed to emergency management and first responder teams to assist in assigning emergency equipment and personnel to localities indicating the greatest damage from an earthquake.

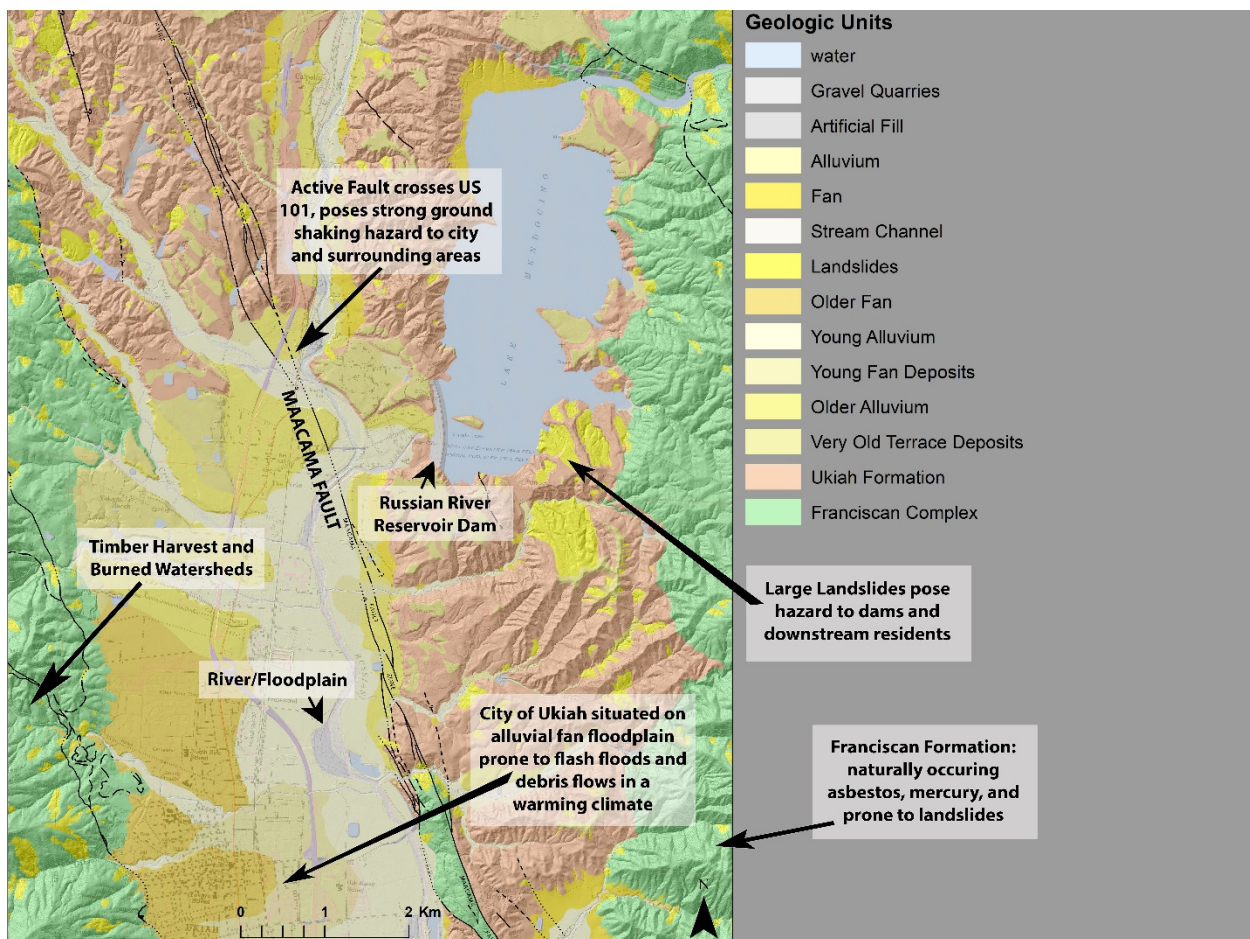


CISN ShakeMap from the magnitude M 7.1 Ridgecrest Earthquake on 5 July 2019. Colors represent the shaking intensity on a scale of 1 (not felt) to 10+ (extreme).

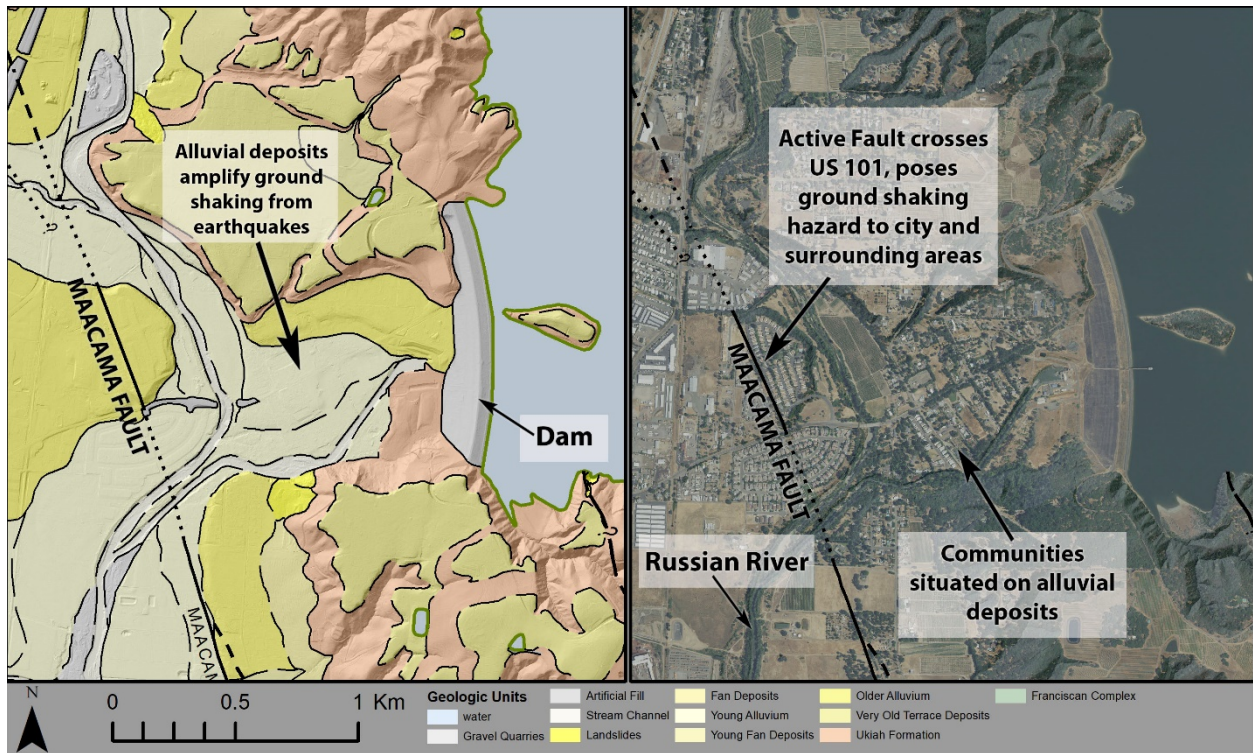
The CGS is working closely with CalOES, USGS, and others in developing and implementing a 2013 state-mandated [California Earthquake Early Warning System \(CEEWS\)](#). The plan is to install or upgrade 1,115 ground motion stations distributed throughout the state to be used in the CEEWS. The CGS has already completed approximately 176 stations, with 66 more stations to be completed by March of 2023. The CEEWS provides advance warning of strong shaking in the event of an earthquake. Individuals can receive audio and visual warnings through the free [smartphone app called MyShake](#). This advance warning can provide individuals with crucial seconds to take cover before strong shaking arrives.

Locating seismic hazards - earthquake faults and surface ruptures, earthquake-induced landslides, liquefiable soils

The CGS conducts regional geologic mapping across California to identify and document potential impacts of geologic and seismic hazards in regions with high population growth, development pressure, significant infrastructure, and climate change hazards. [CGS mapping products](#) are significant resources for the public because they utilize advanced geologic mapping techniques, consider changes in land use development, and include recent mapping from historical geologic events such as earthquakes and landslides, providing the most up-to-date understanding of the regional and local geology across the state.



The geologic map above highlights the various geologic hazards that exist in the Ukiah region of Northern California. The geologic maps produced by CGS provide significant information critical for determining geologic hazard locations and risks.



The above maps from Mendocino County show the close relationship that communities, infrastructure, and developments have with the surrounding geology. Accurately located fault traces and identified geologic units significantly aid in seismic hazard prevention and earthquake preparedness.

The [geologic mapping conducted by the CGS](#) includes geologic interpretation of advanced imagery such as satellite, lidar, and digital elevation model (DEM) processing, as well as vintage aerial photograph analysis, new field mapping, and sample collection and testing. The CGS also reviews previously published and unpublished geologic maps for additional information that is then integrated into the Geographic Information System (GIS) database for each map.

Once digitally prepared, reviewed, and published, the geologic maps are available as free downloadable PDFs. The GIS data used to construct these maps are also freely available to the public upon request. The information presented in the geologic maps provides the public with access to geologic data for the areas that are of interest to them and has the potential to support development decisions made by local municipalities.

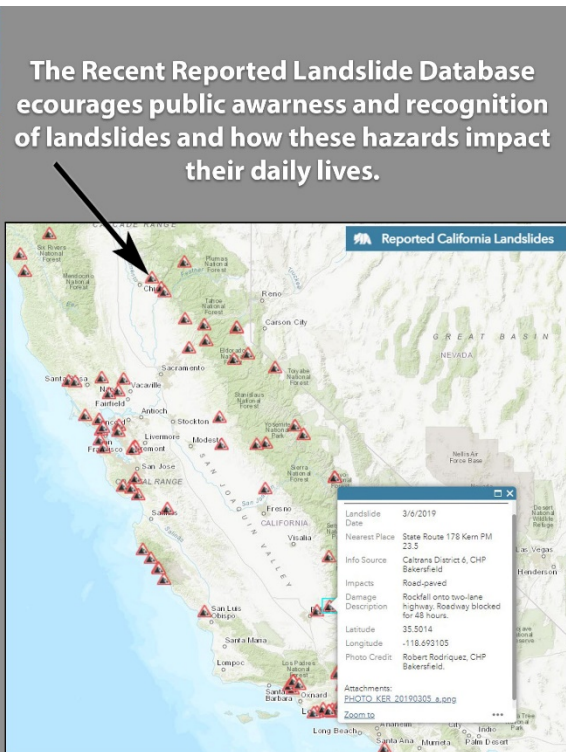
The CGS produces landslide inventories that provide information about the type of landslide, extent of material deposited, the source area, the movement history, and the approximate direction of ground failure. These inventories assist with planning for long-term landslide hazard mitigation, support landslide-aware maintenance practices, and inform developers and planners in counties and cities.

The CGS orchestrates its landslide mapping agenda by coordinating with the projects of the CGS Seismic Hazards Program (SHP), and by contracting with other lead agencies, such as [Caltrans](#). In some parts of the state where seismic hazard zone maps have not yet been produced, the CGS will initiate landslide mapping inventories to assist in the future development of these maps.

Once landslide inventories are completed, they are published on the publicly available [CGS landslide inventory database](#). In 2019, the CGS established a crowdsourced database where members of the public can contribute to data collection efforts by submitting photos and location information of recent landslides to the [Recent Reported Landslides Database](#).



The Landslide Inventory Database displays mapped landslides across California. This inventory provides insight for potential landslide hazards, which includes potential earthquake-induced landslides.



The Recent Reported Landslide Database encourages public awareness and recognition of landslides and how these hazards impact their daily lives.

The CGS Landslide Inventory is a statewide landslide map database that shows many of the landslides mapped by the CGS and others over the past 50 years. The Recent Reported Landslides Database is an online interactive map built on data sent to the CGS by government agencies, media, and community members. Although typically driven by storm events, seismically generated rock falls are also documented.

The CGS geologic and landslide mapping serves as the foundation for maps generated by other CGS programs. The creation of complete and consistent map products across CGS programs increases the efficiency of these programs and results in more accurate data available to the public.

Collaborations with the USGS, Department of Water Resources (DWR), local municipal planning and development departments, private consulting firms, and Caltrans, along with support from the U.S. Forest Service, enable the CGS to efficiently and effectively

gather the data needed to produce the best available and most current geologic mapping products.

California State Mandates – The Laws that Guide our Work

Seismic Hazard Program’s mandates:

- [Alquist-Priolo Earthquake Fault Zoning Act \(1972\)](#).
- [Seismic Hazards Mapping Act \(1990\)](#).
- [California Business and Professions Code sections 7800 – 7887](#), regarding registration of civil engineers and geologists and certification of engineering geologists and geotechnical engineers.
- [Emergency response to geologic hazards, operation of a clearinghouse](#).
- Review of engineering geology and seismology consulting reports for public schools and hospitals (California Building Code).

California Strong Motion Instrumentation Program’s mandates:

- Public Resources Code sections 2700 – 2709.1, Strong Motion Instrumentation Program.
- State legislation (SB 135, Padilla, 2013) provides for the development and implementation of a California Earthquake Early Warning System (CEEWS).

Regional Geologic and Landslide Mapping Program’s mandates:

- [PRC Division 2, Chapter 2, sections 2201 and 2211](#)
- National Geologic Mapping Act of 1992

Funding Sources

The primary funding sources of the CGS in supporting California's resiliency and earthquake preparedness and recovery is the Strong Motion Instrumentation and Seismic Hazard Mapping Fund (SMISHM) and the State's General Fund. In all, the CGS received an annual appropriation for the current fiscal year (21/22) of \$14.1M from the SMISHM Fund and approximately \$4.6M from the General Fund, respectively.

Additionally, the CGS has reimbursement authority for another \$5.5M for contractual work from our partners to support various projects such as the California Earthquake Early Warning project with CalOES, ensuring the safety of our essential facilities (schools and hospitals) through work with Division of the State Architect and the Office of Statewide Health Planning and Development, and increasing the safety of the State's critical infrastructure through partnerships with Caltrans and DWR.

The CGS also receives a small amount of grant funding through our federal partners (USGS and FEMA) that go directly to earthquake mitigation projects.