

VI. IMPROVING COMMUNITY AWARENESS OF THE VALUE OF STRONG-MOTION INSTRUMENTATION

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Introduction

It is a frequent observation that most people in the state of California have little knowledge of strong motion instruments, what they measure, or why they are important to public safety. As a result, public support for this vital element of earthquake safety may inhibit long-term funding for hospital instrumentation and maintenance. The life-safety benefit of robust hospital instrumentation is the ability to quickly identify any hidden structural problems in the affected hospitals that might make them unsafe to occupy. At the current level of hospital instrumentation, the instruments by themselves are not generally adequate to allow HCAI to fully assess damage to hospitals rapidly and accurately after a large urban event or for a large event in rural parts of the state where alternate hospital facilities are limited. HCAI engineers still conduct an in-person review of damage at the site before the affected hospital can be brought back into service after the earthquake. Hospitals lacking instrumentation are completely reliant on those in-person evaluations by HCAI personnel for suitability to reopen after a damaging earthquake. In-person evaluations may take days to accomplish, during which time large aftershocks are likely to occur that could potentially further damage earthquake-weakened structures.

The purpose of this section is to provide HCAI with advice on how to develop and implement an effective outreach program to educate targeted audiences and promote better instrumentation of hospitals and skilled nursing facilities throughout the state.

Targeted Audiences

HCAI might consider three audience groups that can be highlighted for outreach and education efforts. Each of these groups should have a tailored informational message distributed within its ranks. The makers and users of this instrumentation should be getting regular messages that explain what is being measured, how it affects their well-being and why it's important, especially after a significant earthquake.

A. Professional engineering and scientific community

This group primarily includes licensed civil/geotechnical/structural engineers, seismologists and other geoscientists who are involved in design and review of hospital and health delivery development and construction projects. This group also includes university researchers who advance the tools used to produce earthquake-safe structures. Their professional organizations include the Structural Engineers Association of California (SEAOC), American Society of Civil Engineers (ASCE), Seismological Society of America (SSA), Earthquake Engineering Research Institute (EERI), and Association of Environmental and Engineering Geologists (AEG).

Many University of California engineering and geoscience departments conduct advanced research on earthquakes and their measurement, as do Stanford University and University of Southern California. Under the auspices of the latter is the Southern California Earthquake Center (SCEC), which leverages funding from USGS and NSF to provide technical faculty and their students with resources to conduct important earthquake science and engineering research. HCAI should actively participate with these organizations to explore questions and issues that arise from their experiences with hospital performance.

For professionals, the message is that strong-motion records from past earthquakes show how the site actually responds to nearby earthquakes, rather than having to rely on theoretical responses that we would calculate based on earthquake attenuation models. In addition, those records from inside a building show how it responds elastically when it's shaken by different earthquake intensities. If the building's seismic response is not the elastic response pattern that we expect, then something potentially serious has affected the structure of the building and it might be unsafe.

B. Decision-makers, hospital owners, emergency responders

This diverse group includes elected officials, facility owners/operators, and emergency managers and responders. This group needs to have access to good explanations of the information that they are relying on to make decisions that affect the hospital community. Because of the range of specializations in this group, they may be more difficult to reach as a group and require different outreach approaches for subgroups. For example, elected officials at the state level cannot be contacted directly by unelected civil service employees. Such contacts need to be arranged by legislative liaisons at the state department or agency levels. However, state agencies such as HCAI need to prepare informative presentations and illustrated reports that explain what the instrumentation programs do for hospital buildings. Those reports can also form the basis for HCAI staff and their consultants to interact with city and county officials, first responders, and emergency planning personnel, as the need for the information arises.

For decision-makers, hospital building owners, and emergency responders, the message is that their building is instrumented and the strong-motion records from inside the building can go a long way toward determining whether the building remains safe to occupy after the earthquake. Furthermore, regional patterns of ground shaking from an

earthquake can be used in near-real-time to map the locations of the most serious damage areas, since the damage is a function of the local intensity of the ground shaking. Those maps are the most effective basis for rapidly deploying emergency response personnel and equipment and for a quick evaluation of their buildings all over the shaken area.

C. Interested members of the general public

California's citizens are fortunate in that they often feel small earthquakes, which provides an opportunity for them to learn about the importance of instrumentation in the creation of ShakeAlert, cell phone apps such as Quakefeed or USGS alerts, ShakeMaps, and rapid building damage assessments they may hear about from a building owner. The challenge of messaging to this group is in presenting a complicated technical subject in terms they can understand and appreciate.

For the general public, the message might be that the areas of greatest damage are available to them right after the earthquake so that they can stay away from those areas and identify areas where family and friends might need help. They also should understand that strong motion data are critical to the earthquake early warning system so that it can identify when severe ground shaking might arrive where they are located.

Current Outreach Efforts by Others

The California Geological Survey Strong Motion Instrumentation Program (CSMIP) obtains earthquake recording data for structural engineering and seismological purposes through a statewide network of strong-motion instruments. These instruments, installed both on the ground and in hundreds of different types of structures, are monitored and maintained by CSMIP. This program currently oversees approximately 1,300 strong motion stations (over 8,500 instruments) across the state.

CSMIP currently conducts outreach efforts along three paths. The first method occurs through presentations by CSMIP engineers and seismologists at technical professional meetings. This usually includes providing some printed or web-based information on the program at a CGS Exhibit Booth at the appropriate meetings. By its nature, this method is aimed primarily at the professional engineering and scientific community. In addition, CSMIP conducts an annual conference of researchers and developers, and makes those presentations available to the broader technical community. A second method is to work with Department of Conservation Public Affairs Office to develop and distribute information to media outlets, who use radio, TV and print formats to provide this information to the general public. Finally, CSMIP participates in K-12 school events and State Scientist Day, held annually at the State Capital, using their "make-a-quake" interactive instrumentation display. This system allows young students to jump on the ground to create their own "earthquake."

The California Governor's Office of Emergency Services(CalOES) Earthquake, Tsunami and Volcano Program provides some educational information on earthquakes (<https://www.caloes.ca.gov/cal-oes-divisions/earthquake-tsunami-volcano-programs/earthquake-about>) aimed at the general public. Their California Earthquake Early Warning (CEEW) website contains more detailed information on seismic instruments and sensor status in California (<https://www.caloes.ca.gov/cal-oes-divisions/earthquake-tsunami-volcano-programs/california-earthquake-early-warning-program/system-operations>). CalOES CEEW also has an Education and Outreach component that works with the California Broadcaster's Association to develop spots for radio and television (<https://www.caloes.ca.gov/cal-oes-divisions/earthquake-tsunami-volcano-programs/california-earthquake-early-warning-program/education-outreach>).

The California Integrated Seismic Network (CISN) is a consortium of organizations that further the goals of earthquake monitoring through seismic instrumentation. The consortium is made up of CGS, CalOES, USGS Pasadena, USGS Moffett Field, Berkeley Seismological Laboratory, and Caltech Seismological Laboratory. Contributing members of CISN include UC Santa Barbara, UC San Diego, University of Reno, NV, University of Washington, University of Oregon, California Department of Water Resources, Lawrence Livermore National Laboratory, and Pacific Gas and Electric.

CISN hosts the Northern California Earthquake Data Center (NCEDC), the Southern California Earthquake Data Center (SCEDC) and the Center for Engineering and Strong Motion Data (CESMD) (https://www.cisn.org/services/data_centers.html). The latter data center receives strong motion data from throughout the U.S. and from around the world for processing, display, and archiving. Data arriving from the CISN system are automatically processed and offered on the Internet within minutes of an earthquake. Earthquake data from distinct parts of the world may take several days to post because of some countries' data-holding policies. The CESMD archives may be accessed at <https://www.strongmotioncenter.org/>.

The NCEDC and SCEDC, while maintaining catalogs of strong motion data for their regions, also serve as the processing centers for California Earthquake Early Warning (CEEW; ShakeAlert). In California, CEEW is funded by both CalOES and USGS and uses recordings from all CISN partners to produce alerts. Outreach and education efforts are conducted via website-based informational materials produced by CalOES and USGS and can be accessed through CISN (<https://www.cisn.org/>; <https://earthquake.ca.gov/> and <https://earthquake.ca.gov/how-it-works/>; <https://www.caloes.ca.gov/cal-oes-divisions/earthquake-tsunami-volcano-programs/california-earthquake-early-warning-program>).

The Alfred E. Alquist Seismic Safety Commission (SSC) investigates earthquakes, researches earthquake-related issues and reports, and recommends to the Governor

and Legislature policies and programs needed to reduce earthquake risk. Among the duties of the Commission are:

- Managing California's Earthquake Hazards Reduction Program
- Reviewing seismic activities funded by the State
- Providing a consistent policy direction for earthquake-related programs for agencies at all government levels
- Proposing and reviewing earthquake-related legislation
- Conducting public hearings on seismic safety issues
- Recommending earthquake safety programs to governmental agencies and the private sector
- Investigating and evaluating earthquake damage and reconstruction efforts following damaging earthquakes

SSC prepares and disseminates publications on earthquakes and earthquake hazards that target homeowners, commercial property owners, students and teachers, and other audiences (<https://ssc.ca.gov/> and https://ssc.ca.gov/forms_pubs/).

SSC has a special committee, the Strong Motion Instrumentation Advisory Committee (SMIAC), that was established by law to advise the California Geological Survey in the long-term operation and goals of the strong motion instrumentation program (CSMIP). SMIAC has had a long history of involvement including:

- Modification and upgrading of existing instrumentation and addition of new recording devices.
- General use and dissemination of data collected by CSMIP
- Cooperative efforts with other strong motion programs including the USGS
- A direct application of data for use by engineers in the design of structures and modification of building codes

Recommendations for Expanding Outreach

1. HCAI should set up a partnership between HCAI and other state agencies including the Department of Conservation (DOC), Alfred E. Alquist Seismic Safety Commission (SSC), and California Office of Emergency Services (CalOES). These agencies should engage their Public Affairs Officers to develop a coordinated outreach effort that prepares materials and strategies to send group-specific messages that remind them of the value of earthquake instrumentation and inform them about new advances in the field. Outreach can use websites, social media platforms, science podcasts, and/or traditional TV, radio and print media methods. Technical staff input from HCAI and CGS will be

necessary to make sure the messaging is accurate and at the right technical level for the targeted audience.

2. HCAI should consider setting up a partnership between the Legislative Liaison Officers from HCAI, DOC, SSC, and CalOES to develop outreach materials and strategies for engaging California legislators and local government elected officials.

Triggers for frequent, simple messaging to these groups should be identified along with prepared language so that messages can be produced and disseminated quickly.

Examples of message triggers might include:

- Small but felt earthquakes anywhere in the state or in bordering states.
- Damaging earthquakes anywhere in the US.
- Introduction of new instrument technologies or processing capabilities (e.g., improvements to CEEW/ShakeAlert).
- Significant new instrumentation projects (e.g., the new SoFi Stadium in Los Angeles).

Technical staff (engineers, geologists and seismologists) from HCAI, CGS, SSC, and CalOES should identify professional organization publications and meetings and coordinate the preparation of technical papers and presentations that promote instrumentation and new applications.

APPENDIX

Existing Resources for Outreach and Education

California Geological Survey

- CGS Notes 31 - Faults and Earthquakes in California, 2003 (<https://www.conservation.ca.gov/cgs/Documents/Publications/CGS-Notes/CGS-Note-31.pdf>)
- CGS Note 32 - How Earthquakes and Their Effects are Measured, 2002 (<https://www.conservation.ca.gov/cgs/Documents/Publications/CGS-Notes/CGS-Note-32.pdf>)
- Unpublished SMIP Note (Possible replacement for Note 32, 2006; attached)
- CSMIP Brochure (two-page trifold, 2002; attached)
- SMIP Program Summary (two-page program description, 2005-2006; attached)
- CGS Website – <https://www.conservation.ca.gov/cgs/earthquake-data>

Cal OES

Earthquake Early Warning (EEW)

<https://www.caloes.ca.gov/cal-oes-divisions/earthquake-tsunami-volcano-programs/california-earthquake-early-warning-program>

California Integrated Seismic Network (CISN)

<https://www.cisn.org/>

CISN EEW - <https://earthquake.ca.gov/> and <https://earthquake.ca.gov/how-it-works/>

USGS

<https://earthquake.usgs.gov/>

Metropolitan Planning Organizations

- Association of Monterey Bay Area Governments (AMBAG)
- Butte County Association of Governments (BCAG)
- Fresno Council of Governments (FresnoCOG)
- Kern Council of Governments (KCOG)
- Kings County Association of Governments (KCAG)
- Madera County Transportation Commission (Madera CTC)
- Merced County Association of Governments (MCAG)
- Metropolitan Transportation Commission (MTC; aka ABAG)

- Sacramento Area Council of Governments (SACOG)
- San Diego Association of Governments (SANDAG)
- San Joaquin Council of Governments (SJCOG)
- San Luis Obispo Council of Governments (SLOCOG)
- Santa Barbara County Association of Governments (SBCAG)
- Shasta County Regional Transportation Planning Agency (SCRTPA)
- Southern California Association of Governments (SCAG)
- Stanislaus Council of Governments (StanCOG)
- Tahoe Metropolitan Planning Organization (TMPO)
- Tulare County Association of Governments (TCAG)

Temblor

<https://temblor.net/earthquake-news/>