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PUBLIC AFFAIRS OFFICE

801 K STREET • MS 24-07 • SACRAMENTO, CALIFORNIA 95814

PHONE 916 / 323-1886 • **FAX** 916 / 323-1887 • **TDD** 916 / 324-2555 • **WEB SITE** conservation.ca.gov

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Contact: Don Drysdale, CA Geological Survey, 916-719-9903
Leslie Gordon, USGS, 650-329-4006

SEISMIC INSTRUMENTATION OF ONE RINCON HILL TOWER WILL PROVIDE SCIENTISTS AND ENGINEERS WITH IMPORTANT INFORMATION

SAN FRANCISCO – One of the city's most striking buildings is now also one of the most scientifically significant. The California Geological Survey (CGS) and U.S. Geological Survey (USGS) today announced the completion of an effort to outfit the One Rincon Hill (Phase I, South Tower) with seismic monitors that ultimately may impact future building construction across the state and help protect public safety in earthquakes.

"This is a significant achievement for several reasons," said Dr. John Parrish, California's State Geologist and head of CGS. "First, this is one of the tallest buildings in California with seismic instrumentation. Second, we believe we're going to get some unprecedented data from this building because of its earthquake- resilient features, the concentration of the instrumentation, as well as its height. Third, this is the first time that USGS and a state survey have worked together on a project of this type, and that cooperation has resulted in the densest array of instruments (72) in any skyscraper in the U.S."

Dr. William Leith, USGS Senior Science Advisor for Earthquake and Geologic Hazards, added: "I am delighted that the U.S. Geological Survey has collaborated with the California Geological Survey and the One Rincon Hill Association to install state-of-the science seismic instrumentation into this iconic building, which has a unique structural design to enhance its performance during earthquakes."

Scientists say that there's a 63 percent probability of a damaging earthquake magnitude 6.7 or greater in the next 30 years in the Bay Area, a fact the One Rincon Hill South Tower's design takes into account.

At 64 stories and 641 feet high, the tower is not only among the tallest all-residential skyscrapers west of the Mississippi River but is the tallest building constructed using performance-based seismic design (PBSD) standards, which can improve design, cost less, and ease construction.

The building's thick concrete core is attached to "outriggers" -- tall columns of steel-reinforced concrete — by braces that act like shock absorbers during an earthquake. The braces are inside a concrete and steel casing to ensure they maintain their strength during strong shaking. At the top of the building are four tanks capable of holding 50,000 gallons of water; the weight helps with stability both in strong winds and during seismic shaking. The foundation is designed to resist forces 2.5 times stronger than the building code requires.

"While this is an increasingly popular method of construction, it is still relatively unusual and thus we're very interested to see the results from the monitoring instruments," said Dr. Anthony Shakal, head of CGS' Strong Motion Instrumentation Program. "It's important to see how a wide variety of buildings react to seismic shaking. We have a fairly robust collection of instruments on dams, bridges and low-rise buildings such as firehouses. We hope to instrument more high-rises and hospitals in the future."

The seismic instruments, known as accelerographs, measure the vertical and horizontal response of buildings, structures and soils to earthquake shaking. The devices produce a digital record from which the critical characteristics -- acceleration, velocity, displacement and frequency -- of the motion can be calculated.

The instruments at the One Rincon Hill South Tower are producing data from high-resolution motion instruments. They are sensitive enough that the data show that motion caused by wind at the top of the building can be measured to perhaps a thousandth of an inch.

"What we would expect to see in a significant earthquake would be quite interesting," Dr. Shakal said. "The tower is designed to sway up to three feet at the top."

Within moments of a large earthquake, data from the seismic instruments are used to create a "ShakeMap." Among other things, the ShakeMap helps emergency responders determine where the highest levels of shaking have occurred and thus where critical infrastructure – such as transportation corridors and water lines – is most likely to be damaged. The data also is disseminated to seismologists, engineers, building officials, and local governments. It has verified the performance of new types of earthquake- resilient construction and has contributed to improved formulas in the California Building Code for calculating building vibration periods, which is vital in earthquake- resilient design.

"Earthquakes that do significant damage are relatively rare in California, but they are inevitable," noted Dr. Parrish. "California has the most stringent building standards in the world, thanks in part to the data collected by these instruments. Earthquakes that kill hundreds in other parts of the world cause relatively few casualties here. But when it comes to protecting public safety and property, there's always room to improve."

CGS' Strong Motion Instrumentation Program has placed seismic monitors at a number of well-known buildings in San Francisco, including City Hall, the Golden Gate Bridge, the 645 foot Millennium Tower on Mission Street, and the new Public Utilities Commission mid-rise on Golden Gate Avenue. Elsewhere in the Bay Area, instrumentation work was recently completed at the Eden Medical Center in Castro Valley and the Santa Clara Valley Hospital in San Jose. Work is ongoing at the Dumbarton and Antioch bridges, the new span of the Bay Bridge, and in the BART Transbay Tube.

Tom Brocher, Director of the USGS Earthquake Science Center in Menlo Park, noted that the data collected by the seismic instruments can be viewed and downloaded for use in engineering and scientific applications from the joint state-federal data center, www.strongmotioncenter.org.

"The USGS and the California Geological Survey have partnered for many years to record, archive, and make available earthquake strong motion data of engineering interest," he said.

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