The Loma Prieta Earthquake Turns 20:
What We Have Learned from Seismology, Engineering, and Politics

October 17, 2009, is the 20th anniversary of the M6.9 Loma Prieta earthquake. The Loma Prieta earthquake is often referred to as a "wake-up call" that signaled the renewed potential for large earthquakes in the Bay Area. In the twenty years since the earthquake, however, the Bay Area has been fortunate and has not suffered an M > 5.5 earthquake.

The US Geological Survey and the Earth Science community responded forcefully to the challenge presented by the Loma Prieta earthquake. In 1990, the USGS convened the Working Group on California Earthquake Probabilities to evaluate the effects of Loma Prieta on the probabilities of large earthquakes in the Bay Area. This was followed by two subsequent Bay Area working groups in 1999 and 2003; these efforts were fueled by a remarkable and still growing catalog of paleoseismic earthquakes on Bay Area faults. In 2008, the USGS, the Southern California Earthquake Center (SCEC), and the California Geological Survey (CGS) collaborated on the first state-wide earthquake probability report.

These probability reports provide the seismic "drivers" for detailed hazard evaluations in California and the Bay Area. In 1996, the USGS and CGS produced a set of state-wide shaking hazard maps: these maps provided the foundation for the 1997 Uniform Building Code and 2000 International Building Code, which is also the US national building code. Significant updates to models of ground motion attenuation were published in 2008 as a result of the New Ground Motion Attenuation Project of the Pacific Earthquake Engineering Research Center. These models will be fully incorporated into the next set of hazard maps.

The political implementation of hazard information still lags significantly behind these scientific and engineering efforts. The 1989 Loma Prieta earthquake emphasized that site soil conditions affect the severity of the shaking and the damage to the built environment, and exposed many vulnerabilities to structural systems and lifelines. In particular, freeway overpasses and bridges, unreinforced masonry and non-ductile concrete-frame buildings, and soft-story structures suffered critical damage. Better initial design and more complete retrofit of buildings and lifelines could have significantly reduced the damage and loss of life. Currently, the upgrade of building codes addresses only the construction of new buildings, and not the retrofit of older building stock. While Bart and Caltrans have been aggressive in reinforcing their elevated structures, and the cities of the Bay Area have begun to address the problem of their unreinforced masonry buildings, we are only now considering programs to retrofit soft-story buildings in San Francisco and Oakland.

Biography:

Jack Boatwright, a senior seismologist at the U.S. Geological Survey, is currently serving as the Chief of Earthquake Effects Investigations in Northern California. Jack received his PhD in Seismology from Lamont-Doherty Earth Observatory at Columbia University and joined the USGS directly after.

Expertise: The effects of earthquakes and what shaking levels to expect from future earthquakes.

Jack developed maps showing the shaking intensity from the 1906 San Francisco Earthquake and has recently completed a similar map for the 1868 Hayward earthquake. This work has taken him to the oldest sections of cemeteries around the Bay Area, in which he attempts to determine which percentage of the gravestones were broken by the 1868 and 1906 earthquakes. His results are equally spooky, and show that a repeat of either the 1906 or 1868 earthquake will produce strong shaking and damage throughout the Bay Area.