the CUREE-Caltech Woodframe Project

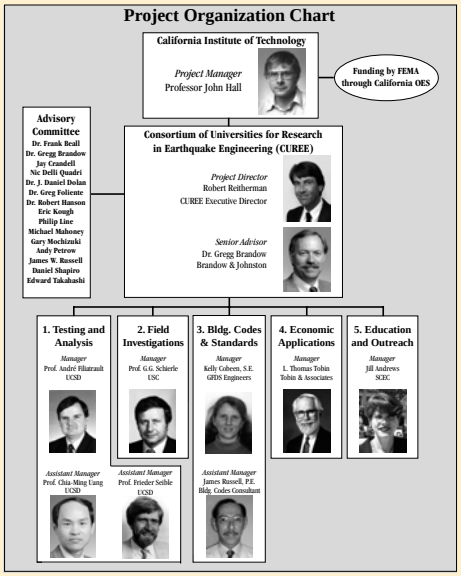
Earthquake Hazard Mitigation of Woodframe Construction

Funded by the Federal Emergency Management Agency through a Hazard Mitigation Grant Program award and administered by the California Governor's Office of Emergency Services

Some woodframe building earthquake damage can be life-threatening, as in the case of collapse or near-collapse. More frequently, the primary threat is economic in nature.

Wood buildings have been seismically researched much less than other basic types of construction—concrete, masonry, and steel—although approximately 80% of the buildings in the USA are made of wood. In California, 99% of the dwelling units are in woodframe buildings, and wood is commonly used for schools and for smaller office and commercial buildings.

Project Organization Chart



1906 San Francisco Earthquake
photo credit: A. C. Lawson, ed., The California Earthquake of April 18, 1906, plate 109 B.
Collapse of the three-story Vendome Hotel Annex, San Jose. Obviously the generalization sometimes made that US-type woodframe buildings have not completely collapsed in earthquakes is untrue. In San Francisco, the four-story Valencia Street Hotel, also collapsed, with a fatality total due to its collapse alone, prior to the fire, difficult to determine but probably in the dozens.

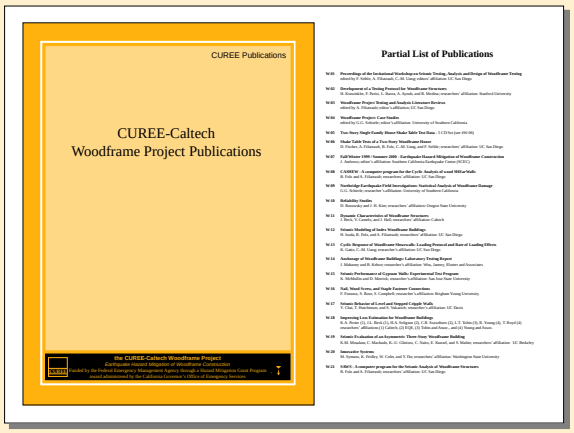
1933 Long Beach Earthquake
photo credit: Austin Studio
Collapse of unbraced cripple walls beneath the first floor is a vulnerability still common in older houses today.

1971 San Fernando Earthquake
photo credit: EERC-NISEE
While it is often said that wooden framing is flexible and absorbs seismic motions, the sheathing materials and their attachment to the frame are just as essential. In this case, the earthquake struck before the sheathing had been applied.

1971 San Fernando Earthquake
photo credit: EERC-NISEE
A soft ground story configuration can be a fatal flaw in woodframe as in other kinds of construction The portion of the house at left was originally two stories.

1971 San Fernando Earthquake
photo credit: Scientific Service, Inc.
The problem of the soft-story apartment building with tuck-under parking surfaced in this earthquake, as well as later in the 1989 Loma Prieta and 1994 Northridge Earthquakes.

1983 Coalinga Earthquake
photo credit: R. Reitherman
Houses propped up on unbraced cripple walls are especially vulnerable.



1989 Loma Prieta Earthquake
photo credit: EERI
Soft-story collapse or near-collapse was evident in some cases in this Bay Area earthquake.

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1994 Northridge Earthquake
photo credit: R. Reitherman
At the Northridge Meadows Apartment Complex, where 16 people died, portions of the ground story completely collapsed.

1994 Northridge Earthquake
photo credit: R. Reitherman
An unknown number of multi-family buildings with parking at ground level, probably in the tens of thousands, exist in California.

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