

# RETROFIT Improvements

## Bracing of Hillside Homes

Making  
Homes  
Safer in  
Disasters

### Retrofit Opportunity

- Seismic retrofits of this scope are finite projects in and of themselves (specialty contractors exist to serve this market)

### Purpose

- To fix/strengthen cripple walls and poor foundation connections
- To prevent a building from sliding off its foundation during a seismic event

### Benefits

- Ensures safety to occupants and property

### Hazards

Wind



Rain



Flood



Seismic



Fire



Snow

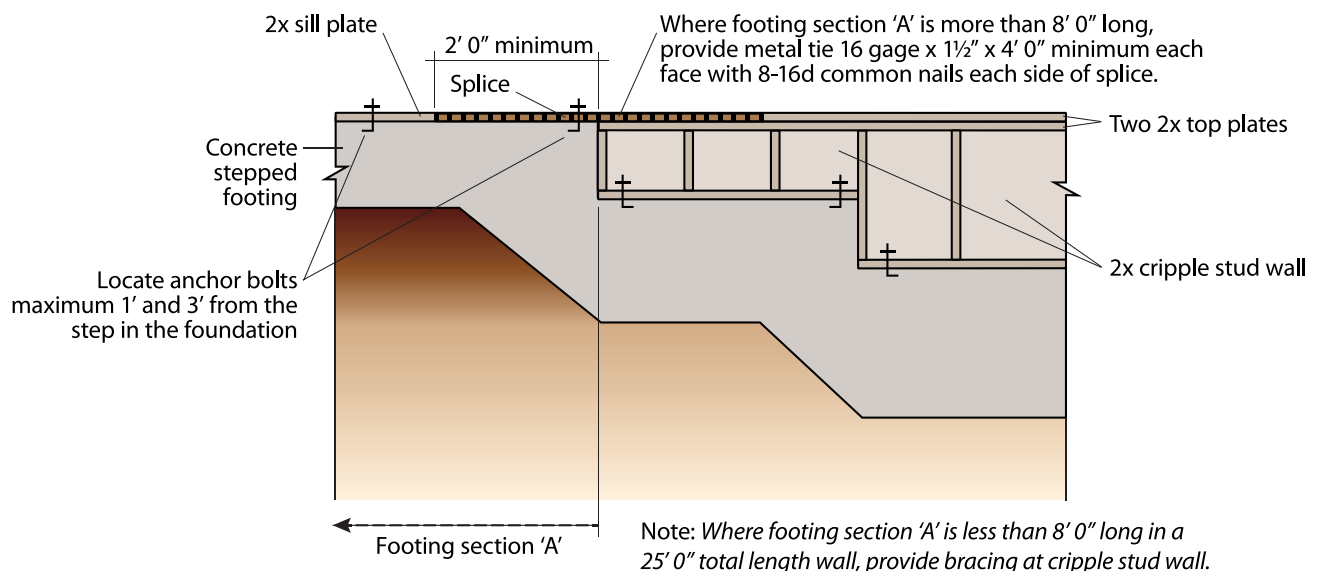


### Summary

Forensic investigation indicates that partial or complete collapse of hillside houses is a common calamity when earthquakes hit. The most at risk houses have the entry floor located at or near street level and tall wood light-frame walls providing support at the hillside edge of the floor. These homes may have a "walk-out" basement. Referred to as down-slope houses, the largest level is supported by a discontinuous foundation that "flows" with the grade which slopes down and out. The structure between the foundation and the main level of the house, as typically constructed, provides a poor interconnection that is susceptible to shaking. Walls at the sides of down-slope houses are also irregularly shaped as they are "stepping" down the hillside. These cripple walls, and the fact that the main floor is usually pinned to an upper and lower foundation (which are disconnected), provide many pivot points from which the rigid floor system may shake out of plane and cause failures of the elements that support it. Retrofitting downslope houses is a job that requires an engineered design and specialty contractor. As a result, the cost of this retrofit will vary with the scope of the project.

### Illustration

#### Retrofit



Detail of shear wall construction and anchorage at stepped foundation

## Potential Damage



Photo: [www.fema.gov](http://www.fema.gov)

## Key Steps

- Hire a professional inspector to determine the scope of a retrofit.
- Generally speaking, this retrofit will incorporate primary and secondary anchoring of the main floor system and load path reinforcement components.
- Your contractor may have additional ideas on how to improve the safety of your home.
- For more details about this retrofit improvement, please refer to the list of Resources in the section below.

## Resources

FEMA, *Earthquake Safety Guide for Homeowners*

<http://www.fema.gov/library/viewRecord.do?fromSearch=fromsearch&id=1449>

FEMA, *Homebuilders' Guide to Earthquake-Resistant Design and Construction*

<http://www.fema.gov/library/viewRecord.do?id=2103>

