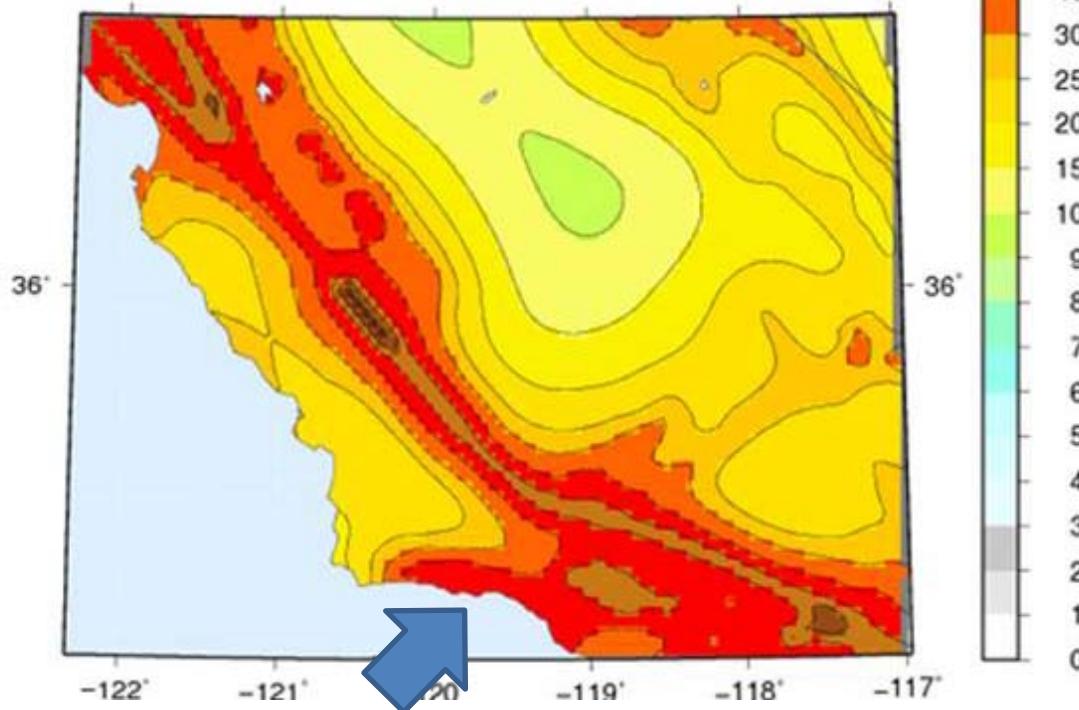


# Earthquake Hazard for Buildings in Santa Barbara County

# Custom Hazard Map



**Capable of generating 7.0 Mw EQ**

- Not the highest in the State of California
- Capable of causing hundreds of millions of dollars in damages and loss of life

# Content of Report

- Identifies vulnerable building types
- Identifies actions by other jurisdictions
- Makes recommendations for next steps
- The report does not address:
  - a) Earthquake related geological hazards
  - b) Post-earthquake Fire Hazard
  - c) Tsunami
  - d) Public buildings and infrastructures

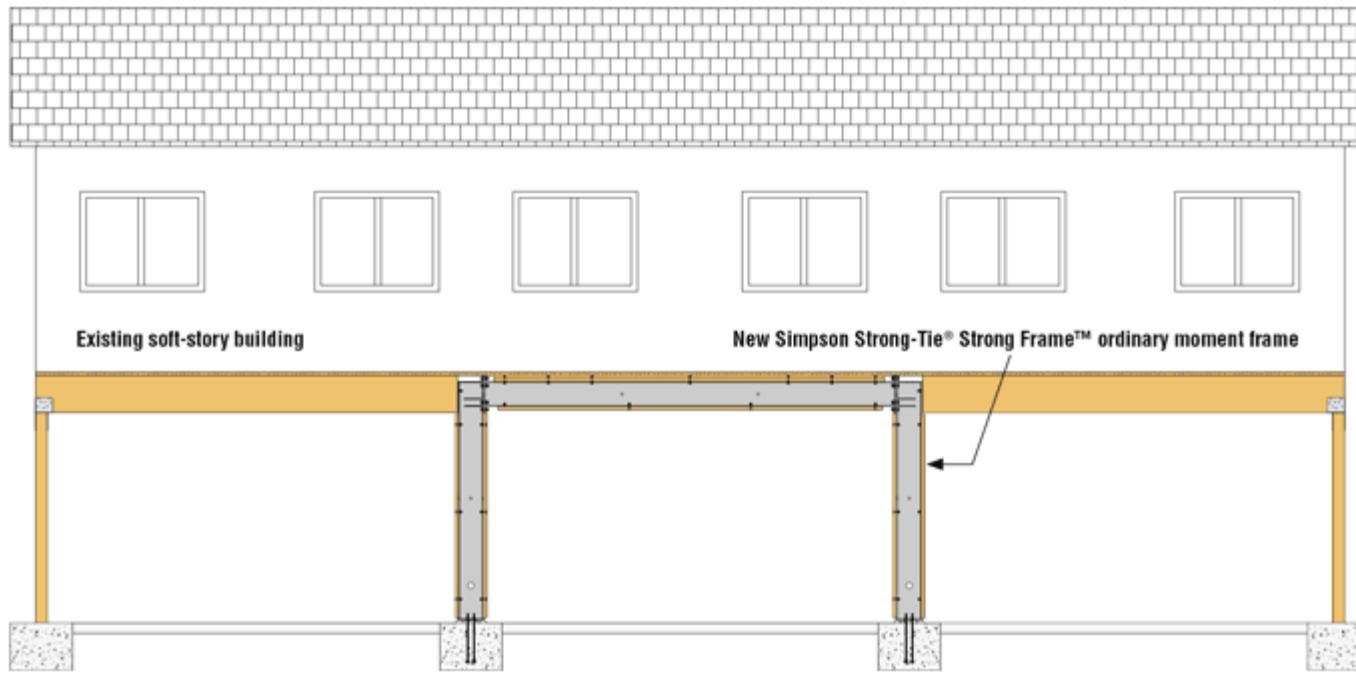
# Soft-Stories



# Soft-Story

- Soft Story construction is a weak story in a building, typically open ground level parking.
- Not a common building type in Santa Barbara County.
- Retrofit Cost: \$4 to \$10/sft
- Post EQ repair cost: \$20/sft plus loss of income
- Other benefits of retrofitting :
  - Saves lives
  - Increases value and lifespan of the building

# Typical Soft-Story Retrofit



Courtesy of Simpson Strong-Tie

# Soft Story in Northridge Earthquake



Several fatalities and total loss of the building

# Pre-1973 Concrete and Concrete Masonry Buildings with Flexible Floor or Roof

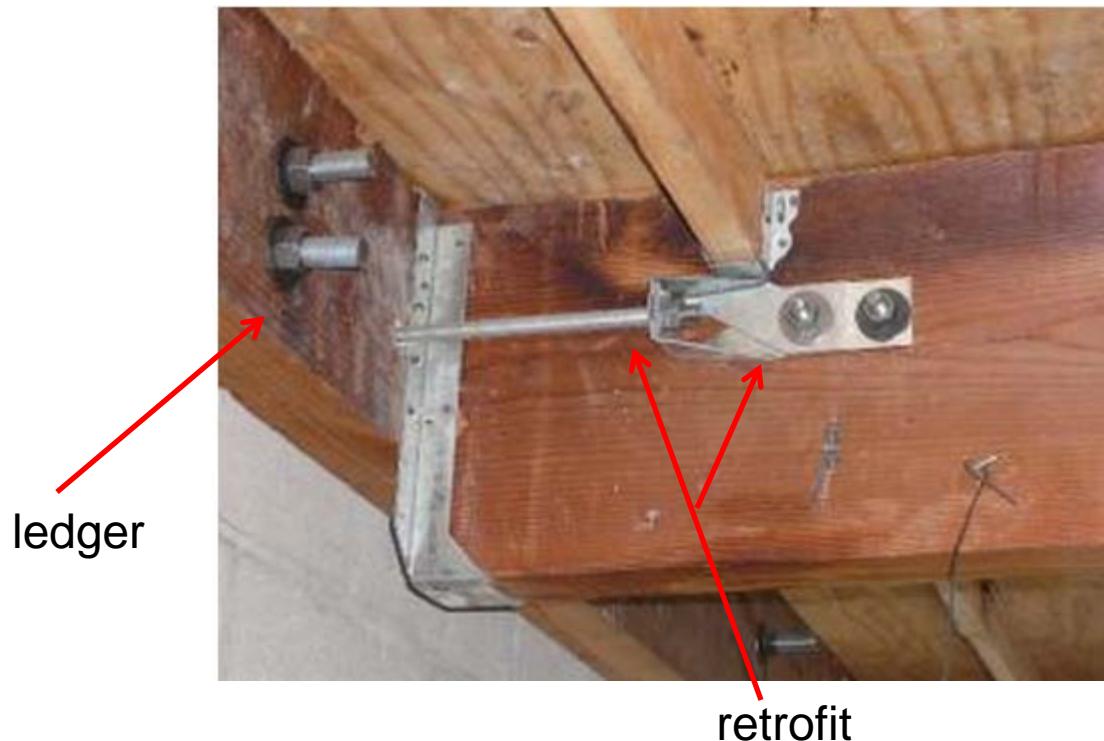


Picture courtesy of Reid Middleton

# Pre-1973 Concrete and Concrete Masonry Buildings with Flexible Floor or Roof

- Separation of the concrete/masonry walls from roof causing partial or complete failure.
- Expect few buildings of this type in Santa Barbara County.
- Retrofit is relatively simple without major structural alterations.

# Repair for Pre-1973 Concrete and Concrete Masonry



# Homes without Bracing in Crawl Space



Napa, Calif., Monday, Aug. 25, 2014

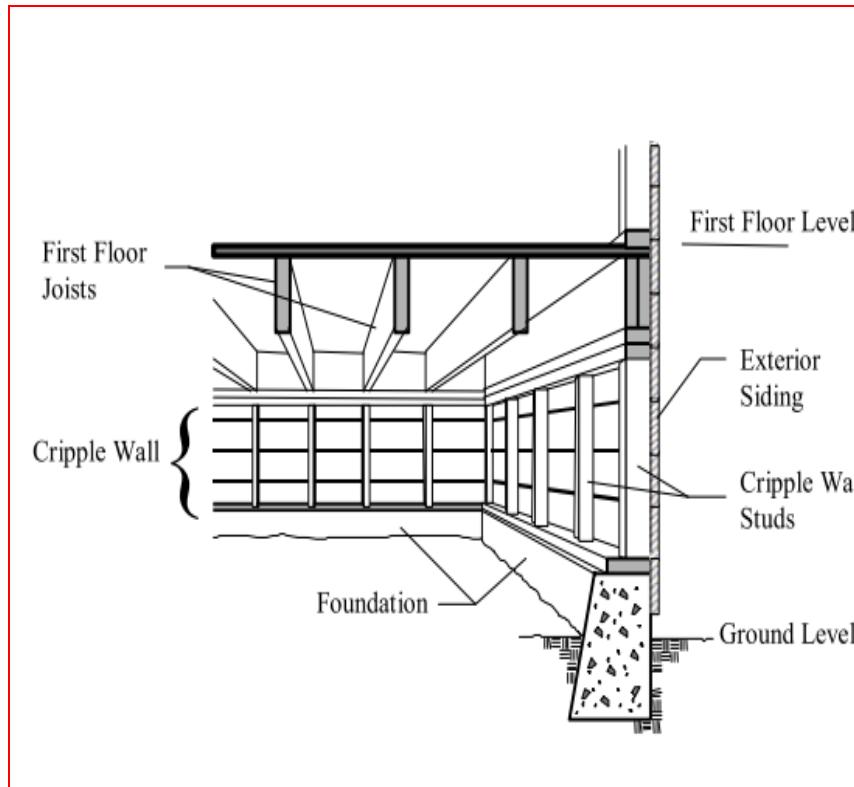
Courtesy of , Karl Mondon/Bay Area News Group) (Karl Mondon)

# Homes without Bracing in Crawl Space

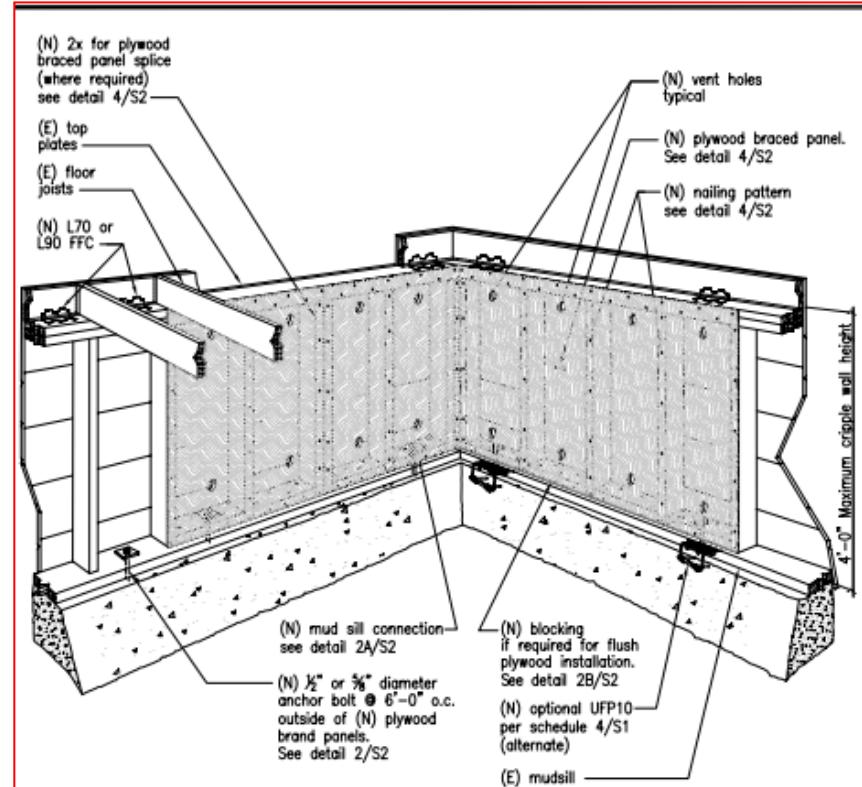
- Typically pre- 1950 lacking:
  - Wall sheathing inside face of crawl space wall
  - Sill plates not anchored to the foundation
  - Causes homes to fall off the foundation in earthquake
- We expect to find many homes with this construction.
- Very low cost retrofit.

# Homes without Bracing in Crawl Space

Before

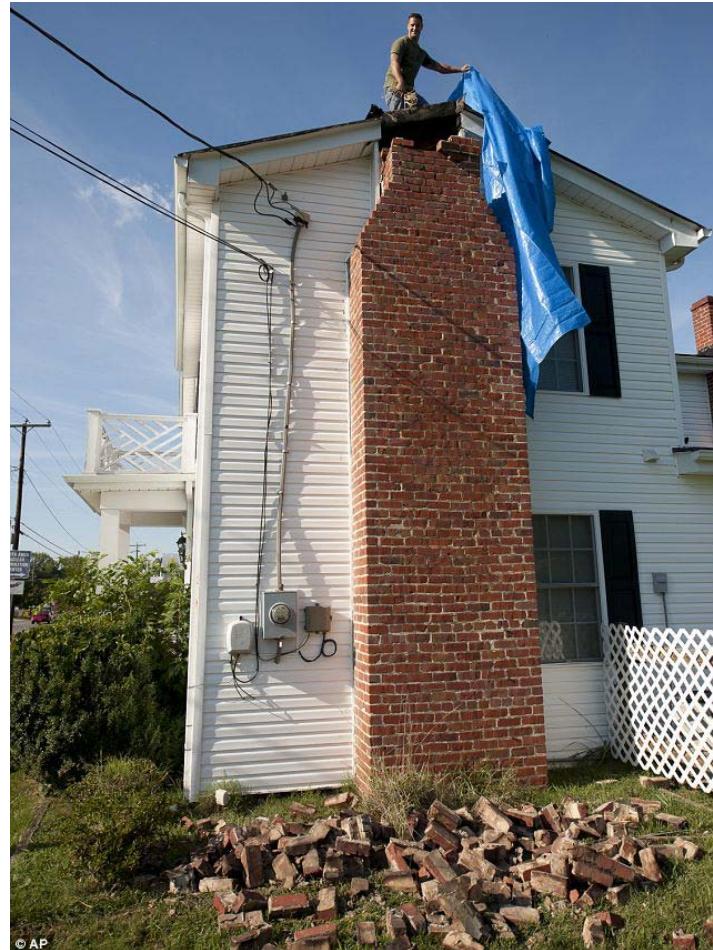


After



# Masonry Chimney Failure

- Unreinforced masonry chimney
- Not connected to roof/floor
- Chimney breaks and falls
- Expect many in the County



# Masonry Chimney EQ Retrofit



## Retrofit Options:

- Bracing
- Replace with wood framing
- Place plywood over ceiling to protect the occupant from falling bricks

# Pre-1994 Mobile Home



# Pre-1994 Mobile Home

- Pre- 1994 Mobile homes installed on metal pedestals not designed for earthquake forces.
- Mobile Home can fall from the pedestals causing damage and even fire due to ruptured gas lines.
- 25 MH parks with 2,729 spaces in Santa Barbara County.
- Only State Housing and Community Development (HCD) can enact retrofit program.

# Non-ductile Concrete Moment Frame



Photo Credit: M. Celebi, U.S. Geological Survey

# Non-ductile Concrete Moment Frame

- Concrete building constructed to pre-1976 code; buildings may have:
  - Inadequate steel reinforcement
  - Causes sudden loss of strength and failure



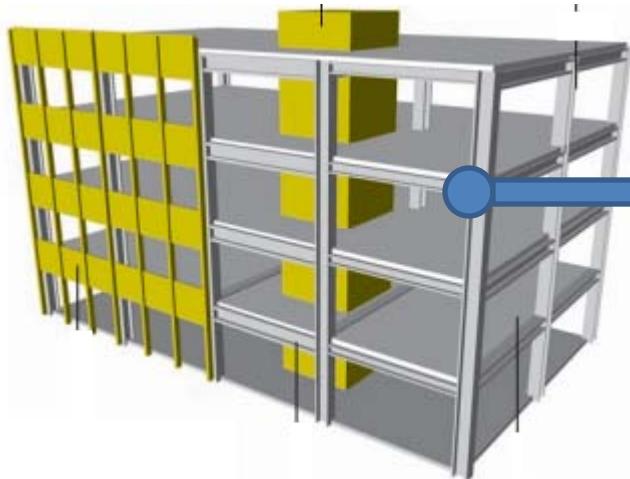
Olive View Hospital, 1971 San Fernando Valley earthquake

# Non-ductile Concrete Moment Frame

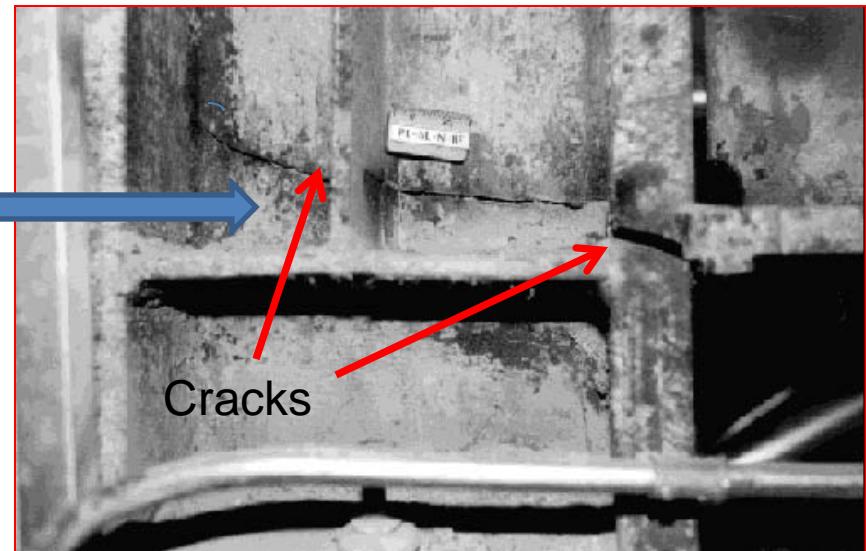
- Not a common building type in Santa Barbara County.
- Some hospitals, school/colleges, government buildings have been retrofitted.
- Retrofit methods vary drastically and are costly.

# Pre-Northridge Steel Moment Frames

A typical Steel Frame Building



Fracture in welds



# Pre-Northridge Steel Moment Frames

- Most hazardous in mid-rise to high-rise buildings.
- Not a common building type in Santa Barbara County.
- Retrofit varies and expensive.
- Used in residential construction but not considered a significant risk due to supporting light weight wood framing.

# Unreinforced Masonry Building URM



# Unreinforced Masonry Building (URM)

## Past Mitigation Program

- State law required inventory of these building in the 1990s.
- Santa Barbara County passed a mandatory retrofit ordinance in 1994.
- The program included privately owned buildings and excluded public buildings.
- All URM buildings have been retrofitted or demolished.

# Other Jurisdiction Mandatory Retrofit

- Mandatory URM in neighboring jurisdictions:
  - County of Ventura, County of San Luis Obispo, City of Santa Barbara, City of Ventura, City of Solvang,
- \*City of Lompoc, Posting Placard
- Soft-Story Mandatory:
  - Fremont, Berkeley, San Francisco
- Tilt-up:
  - Los Angeles, Fremont

# Recommendation

## Single Family Residences

- Develop voluntary retrofit and educational programs.
- Develop options for future consideration for mandatory retrofit when substantial modifications or additions are proposed.
- Prepare code amendments to address construction on steep hillsides.

## Non-Residential and Multi-Family

- Conduct survey to identify at risk buildings.
- Conduct owner outreach.
- Develop options for future consideration for retrofit programs.

# Requested Board Action

- Receive and file the attached report on Earthquake Vulnerability of Buildings in Santa Barbara County;
- Direct staff to survey and identify buildings in the unincorporated areas of the County that are at considerable risk of major damage in the event of an earthquake; and
- Direct staff to return with recommendations to address at-risk structures identified in the survey.
- Receive a presentation from California Seismic Safety Commission officials on the Commission's work to assist local governments in reducing earthquake losses, increasing resiliency and enhancing recovery.
- Determine that the above actions are exempt from the California Environmental Quality Act (CEQA) pursuant to State CEQA Guidelines Section 15262 and the Notice of Exemption, included as Attachment 2.