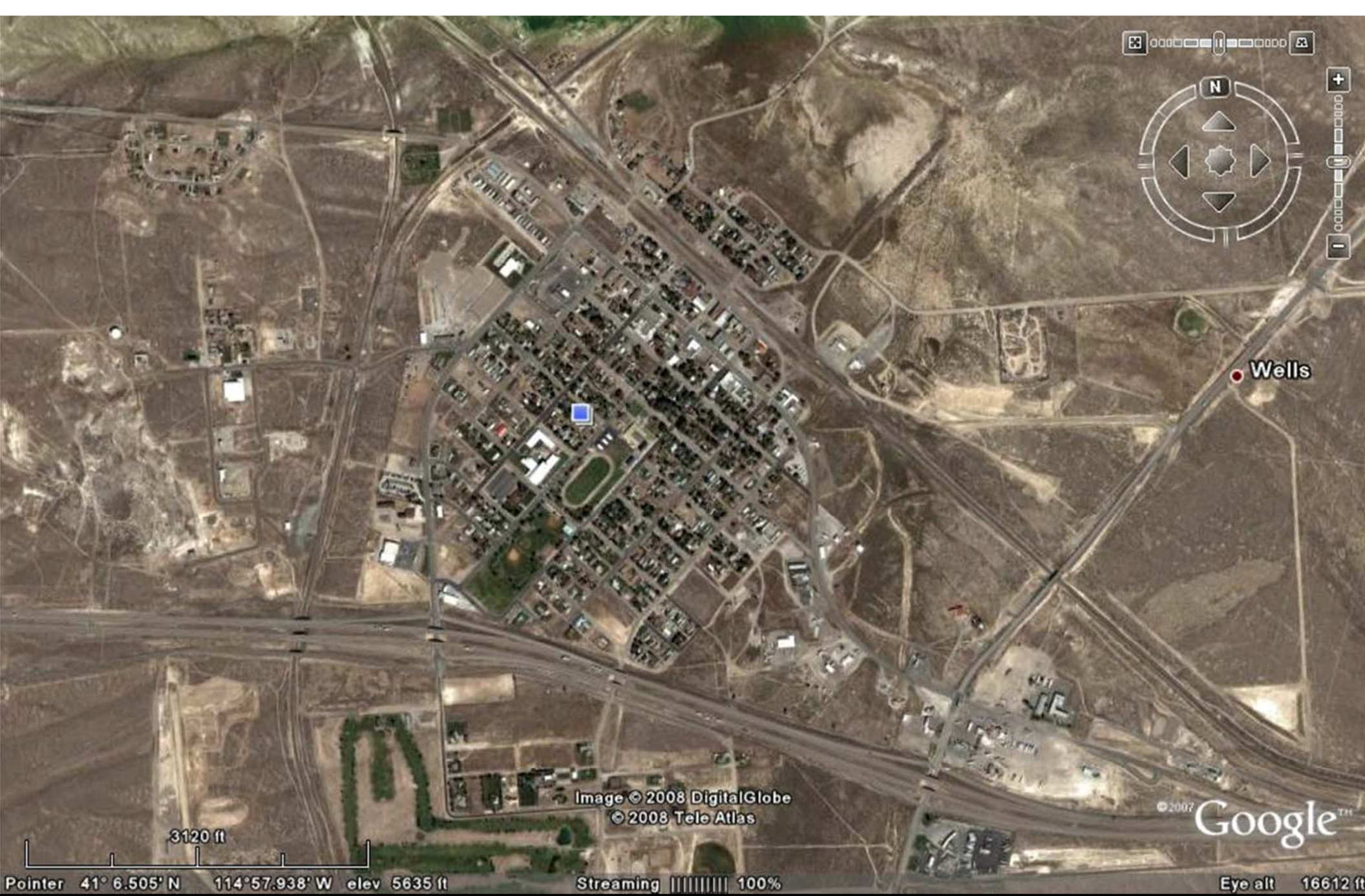


Damage from the 2008 Wells, Nevada Earthquake

Craig M. dePolo
Nevada Bureau of Mines and Geology
University of Nevada, Reno



~80 non-residential buildings
~450 homes



The Earthquake

- 30 to 40 seconds of shaking,
- Began with a loud bang; explosion like,
- Epicenter was 9 km NE; ruptured to within 2 km of town,
- Collapse, partial collapse, parapet and wall collapse in old town,
- 3 homes destroyed, over 60 chimneys damaged.



Wells Nevada
WELLS

S. QUILICI & SONS

BARGAIN BARN



Damage

- Severe damage to weaker buildings,
- Moderate to light damage to modern buildings (UBC 1997 used),
- Lots of cracks from shaking in all buildings,
- More structural damage than initially thought,
- Most people had about \$500 worth of nonstructural damage.

Earthquake Damage

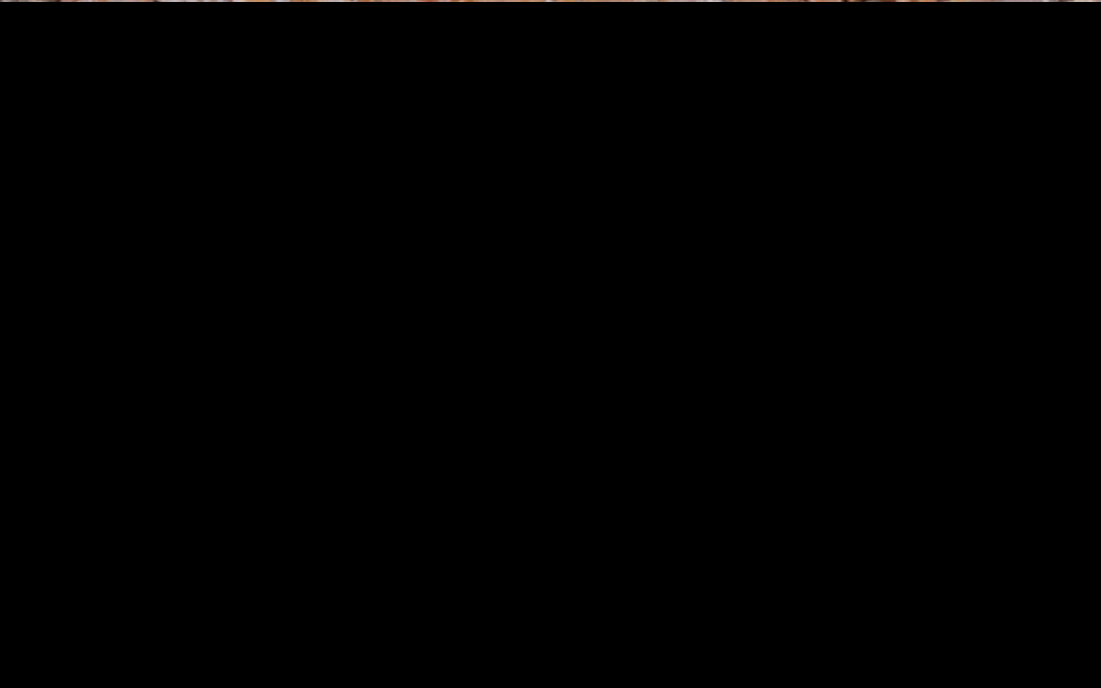
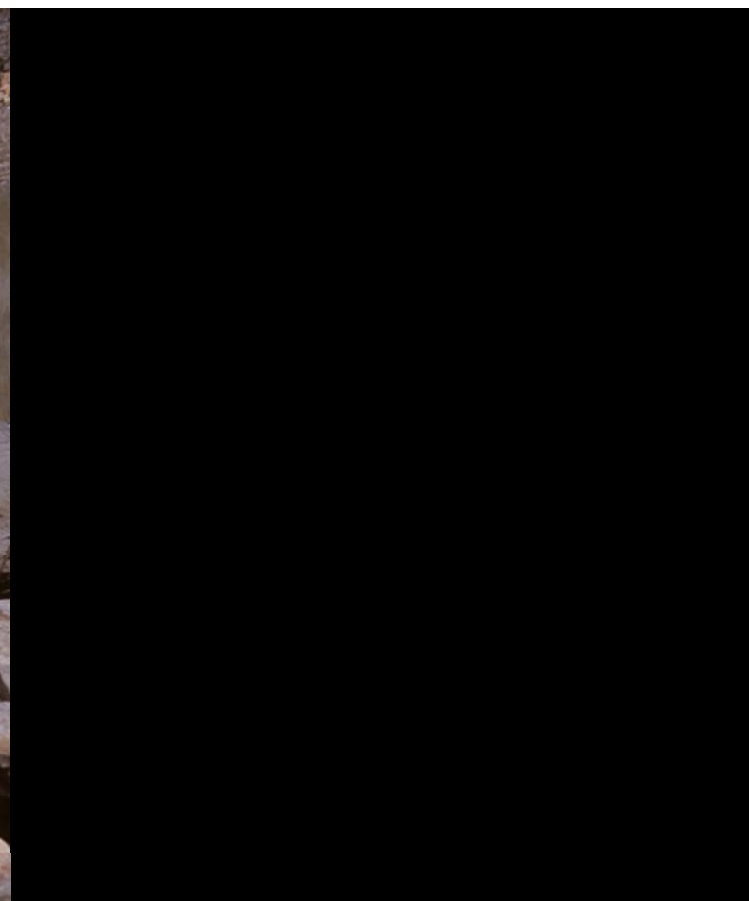
- 35 out of ~80 buildings damaged (44%),
- 10 had severe or heavy damage (13%),
- 3 out of ~450 homes were severely damaged,
- >60 chimneys were damaged (10-15%).

Severe Damage

- Collapsed building,
- Partially collapsed buildings,
- Parapet and upper wall failures,
- Unreinforced brick veneer failures,

Building Collapse



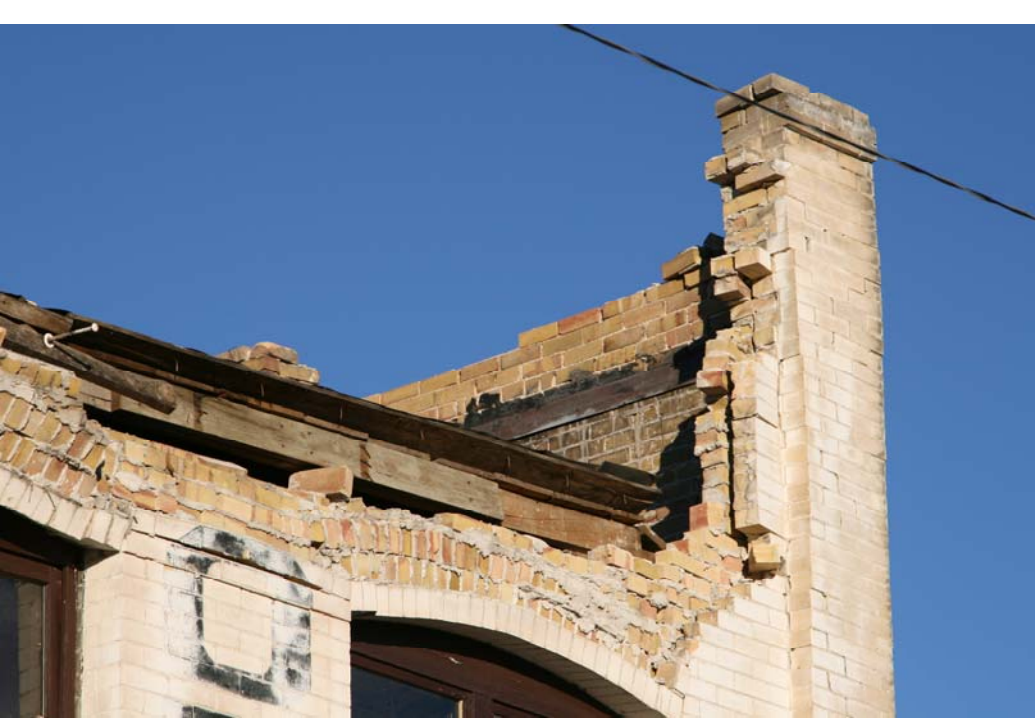




Partial Building Collapses

- Nevada Hotel roof failure,
- Mint Saloon roof crushed by bricks from the Nevada Hotel,
- El Rancho upper wall failures,









Collapse hazard of a wood-framed building because of adjacent URM failure.



Parapet and Upper Wall Failures



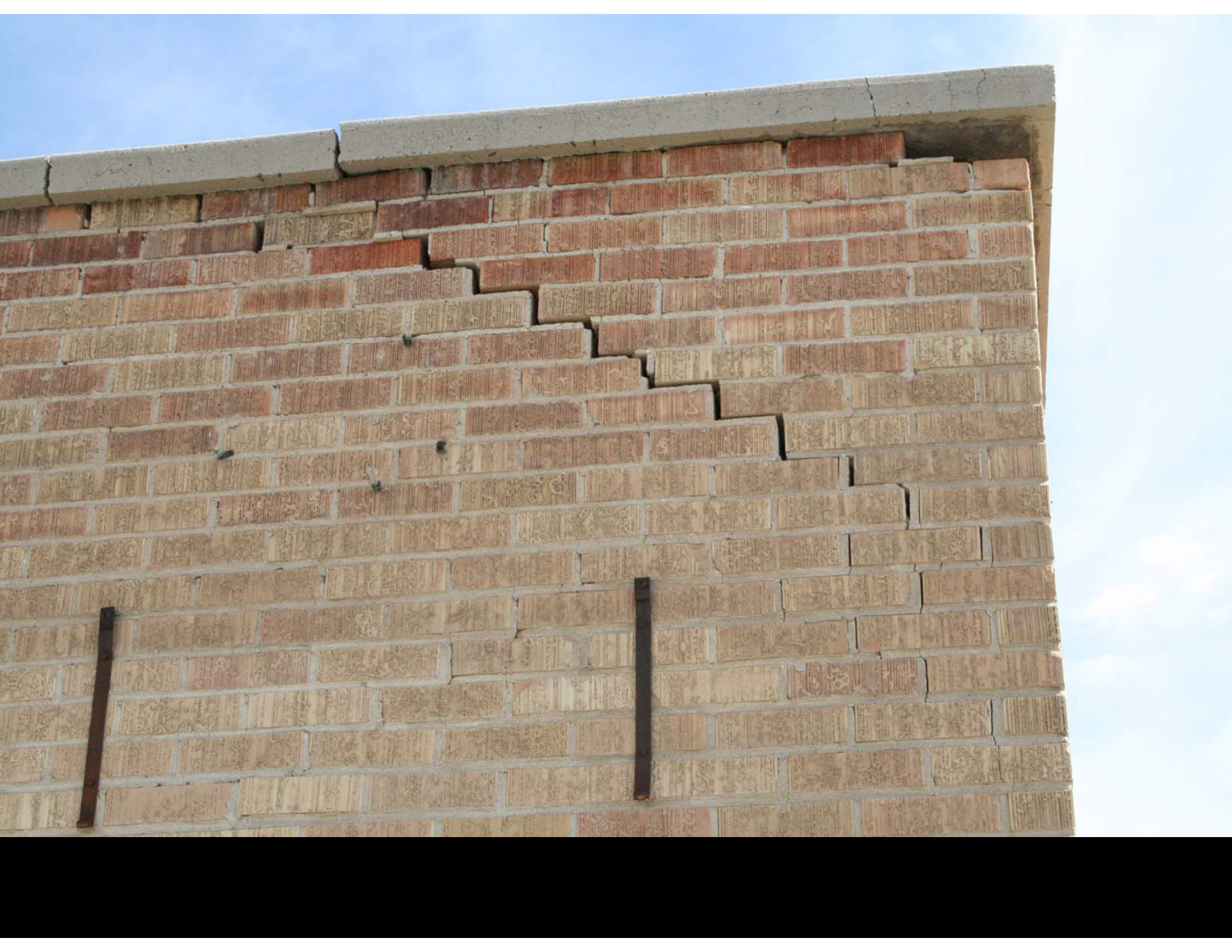


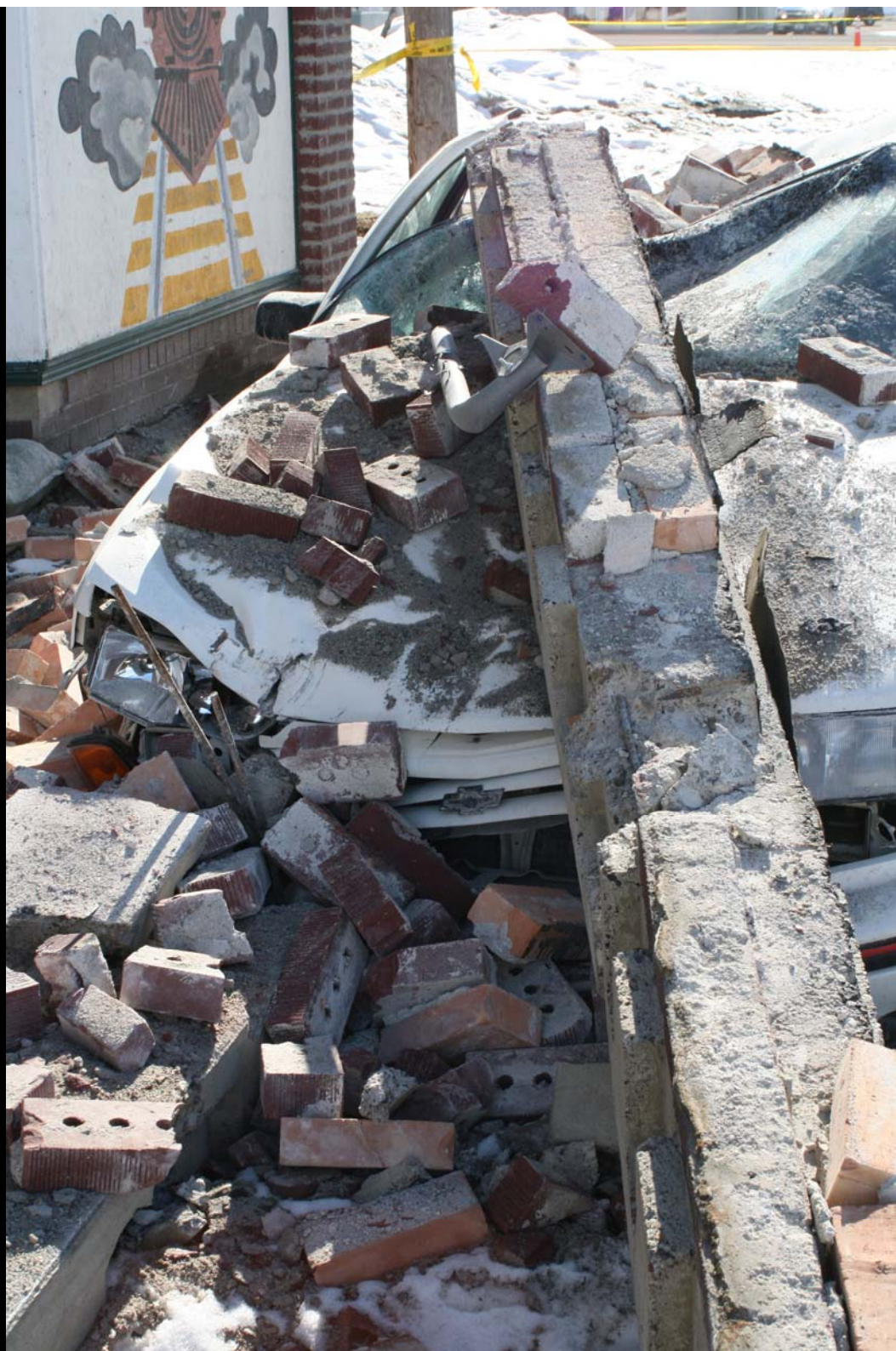




Building Pounding







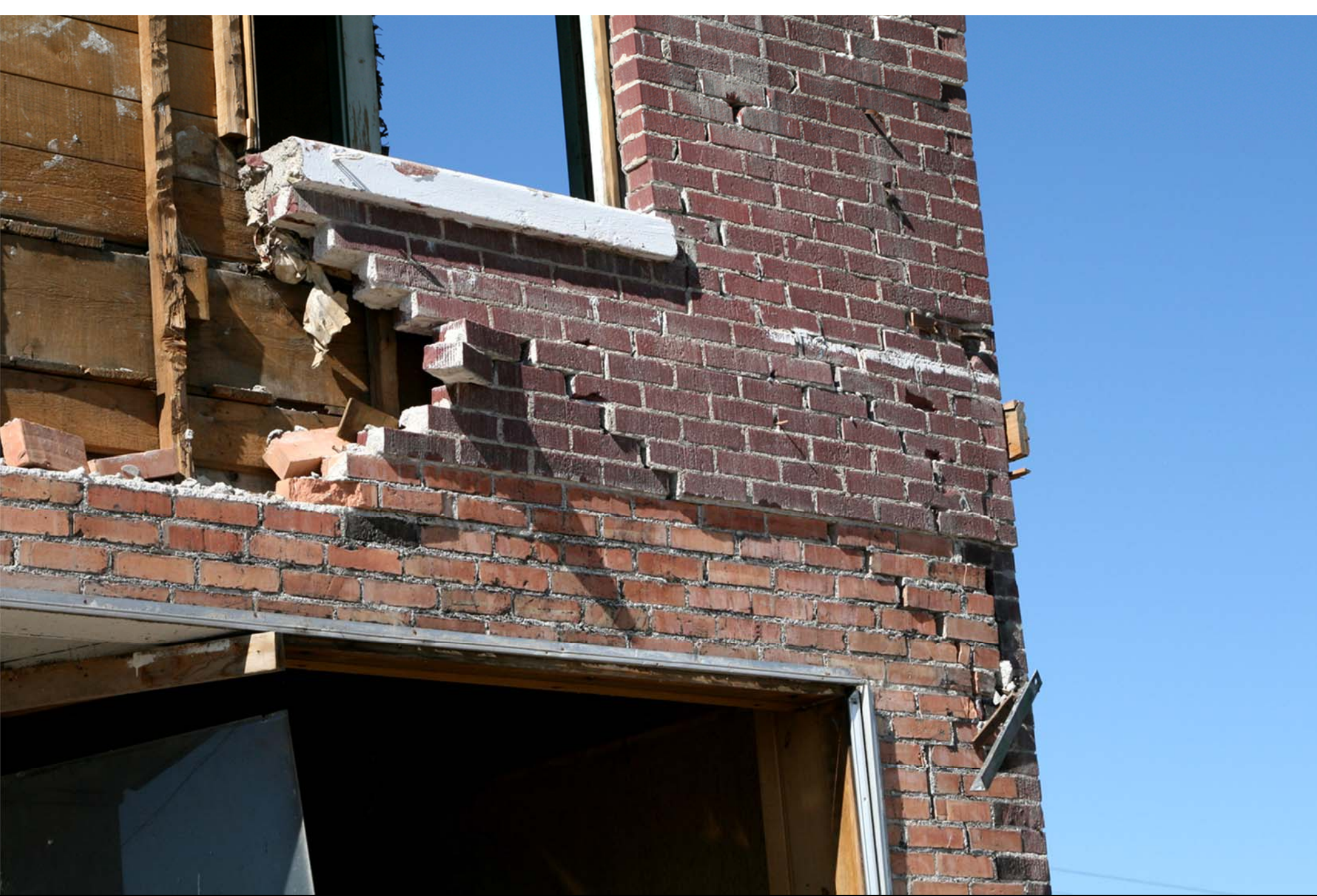
Unreinforced Brick Veneer



Photo by Sue Chapman



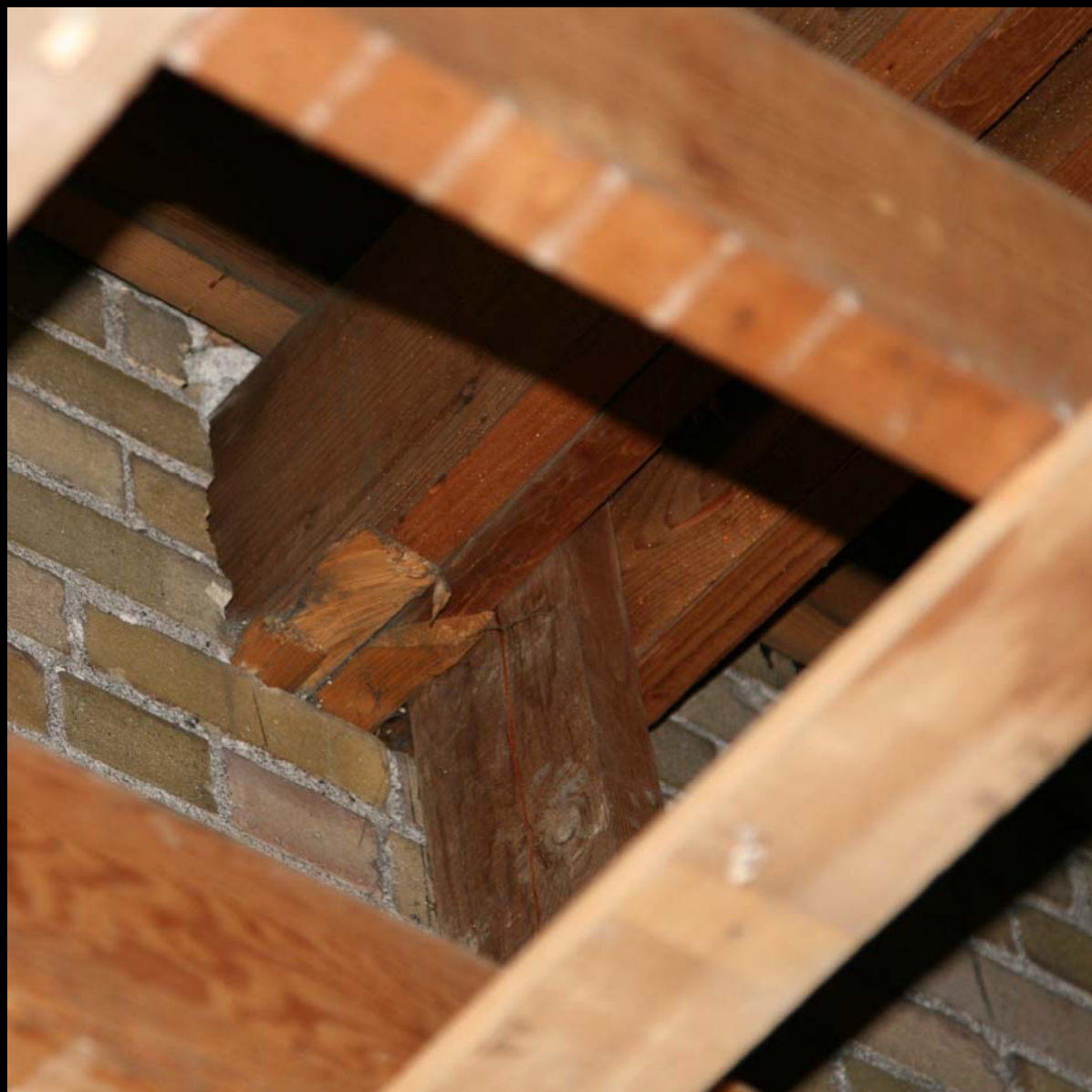








Connections









URM Problems



Unfired bricks (above); rubble in-fill (to right)

Some non-residential URB Stats:

- 10 of 15 moderately or severely damaged (67%) – potentially life threatening.
- 4 of 15 partial to total collapse (27%).
- 2 of 15 potentially deadly staying inside (13%).
- 15 of 33 exits had potentially deadly debris (45%)

Variations in Damage

- Old town versus City Hall
 - Maintenance? Location? Orientation?
- Old town north of alley versus south?
(say Nevada Hotel versus Old West Inn)
 - Variations in alluvial thickness?
- Two stories versus one story

**Construction
Defect?**

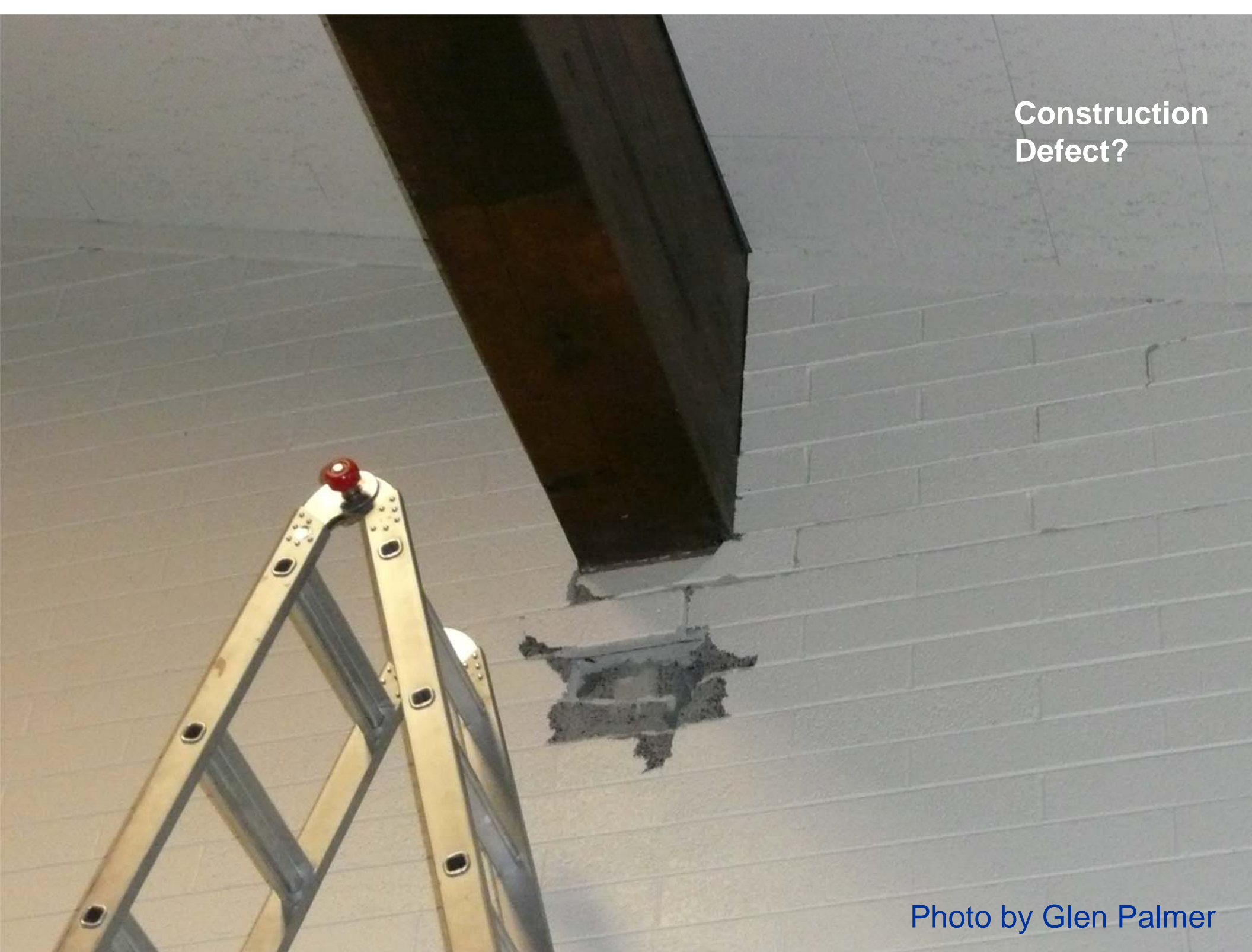


Photo by Glen Palmer

Damage to Homes





Photo by Glen Palmer

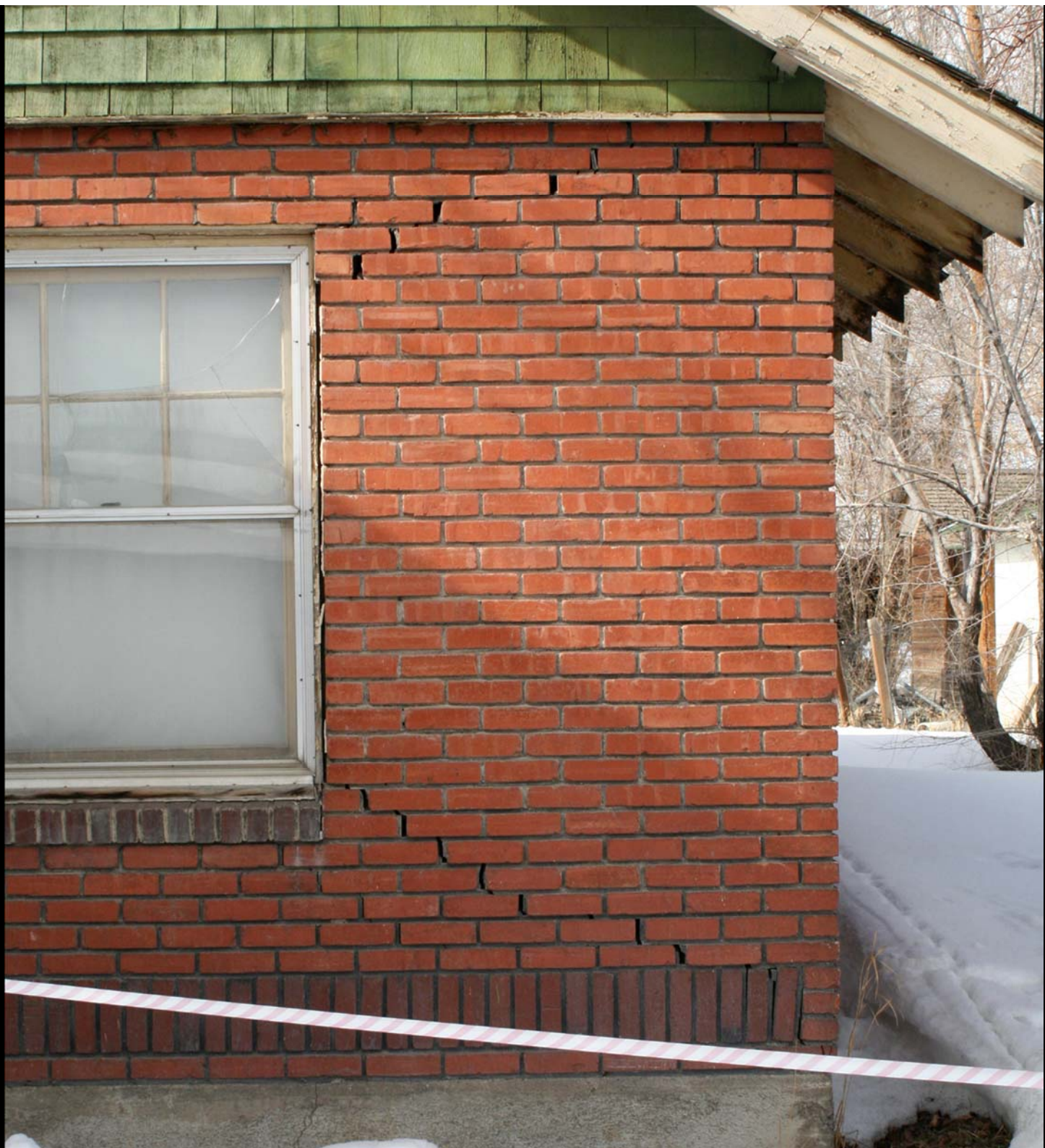
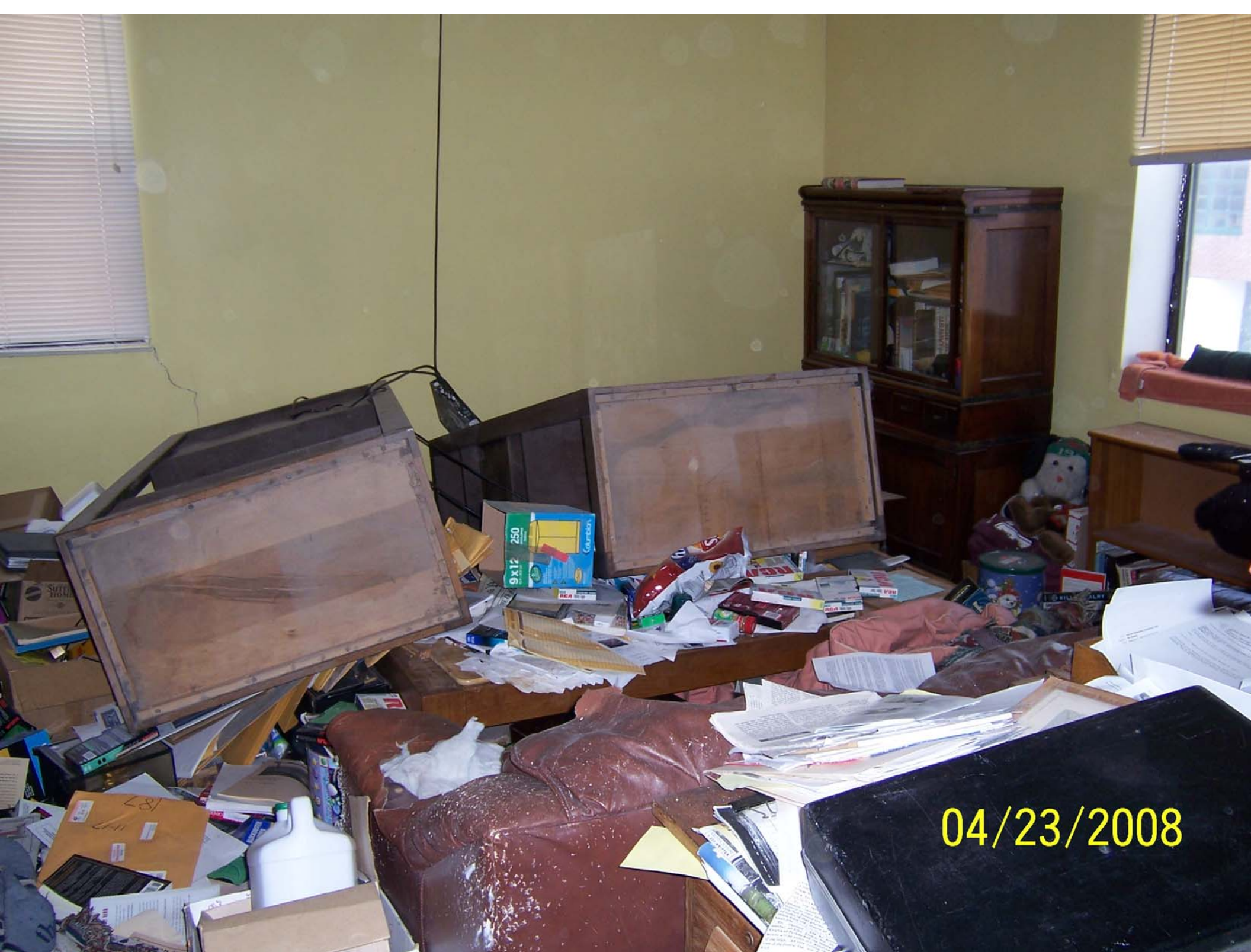






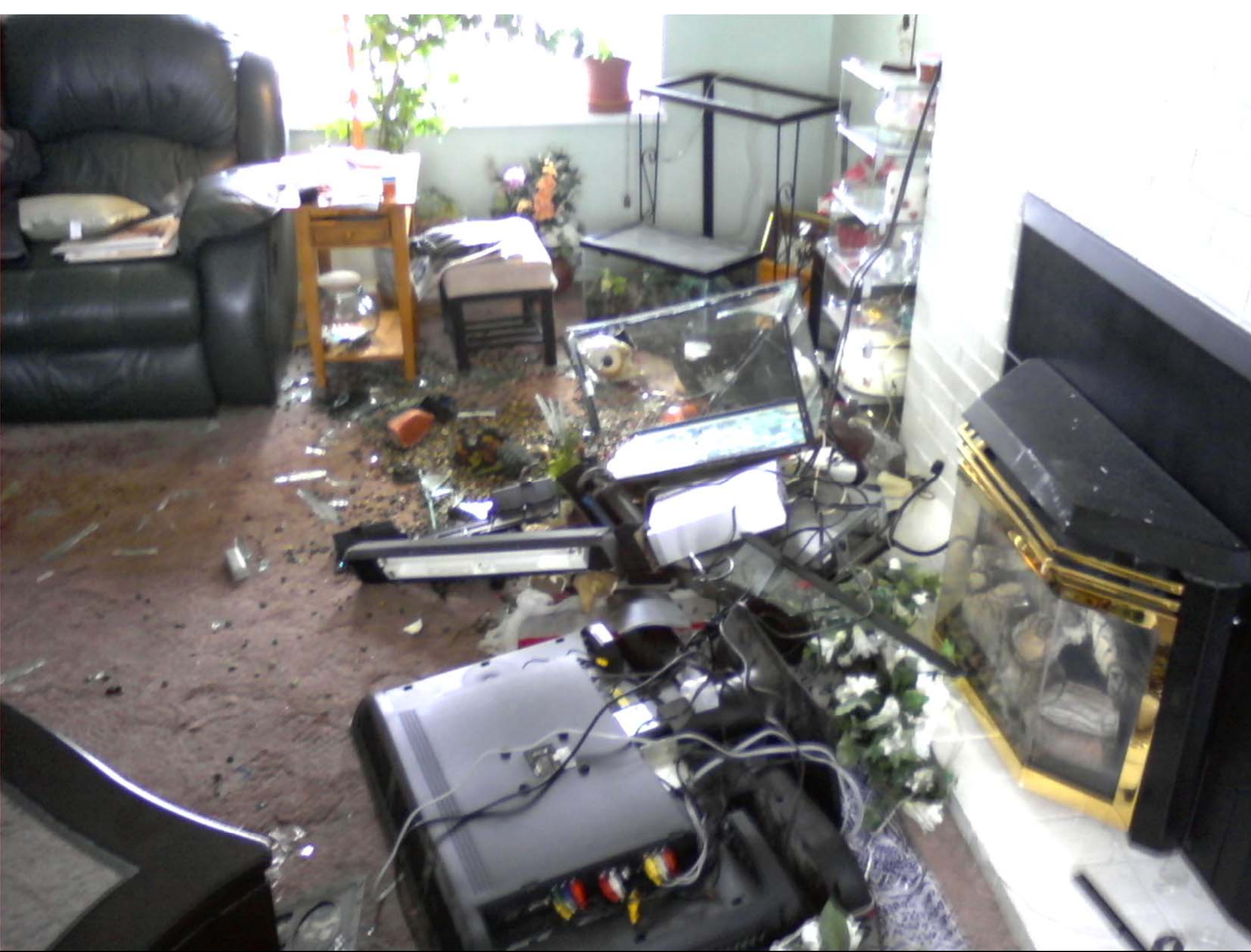


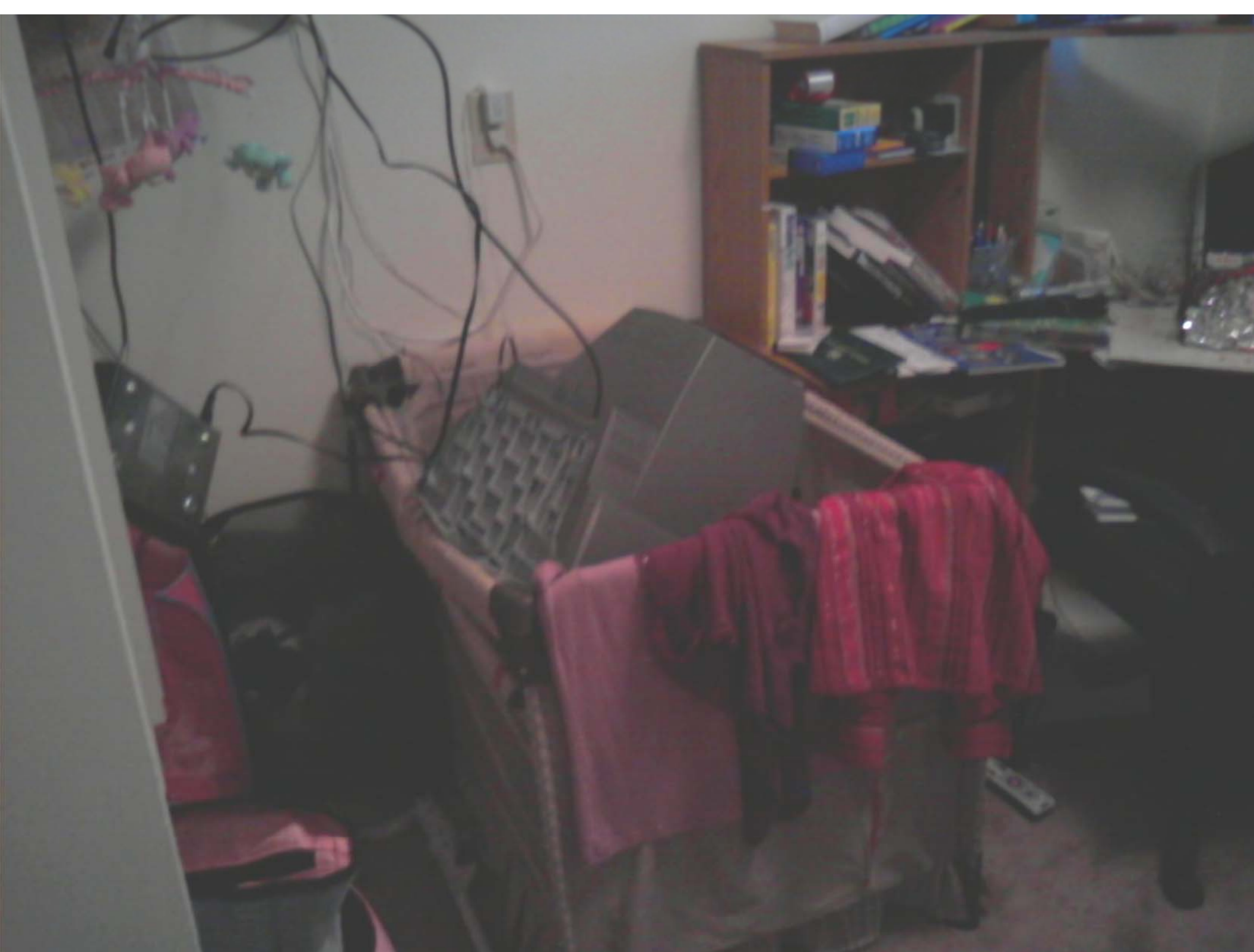
Photo by
Glen Palmer



04/23/2008



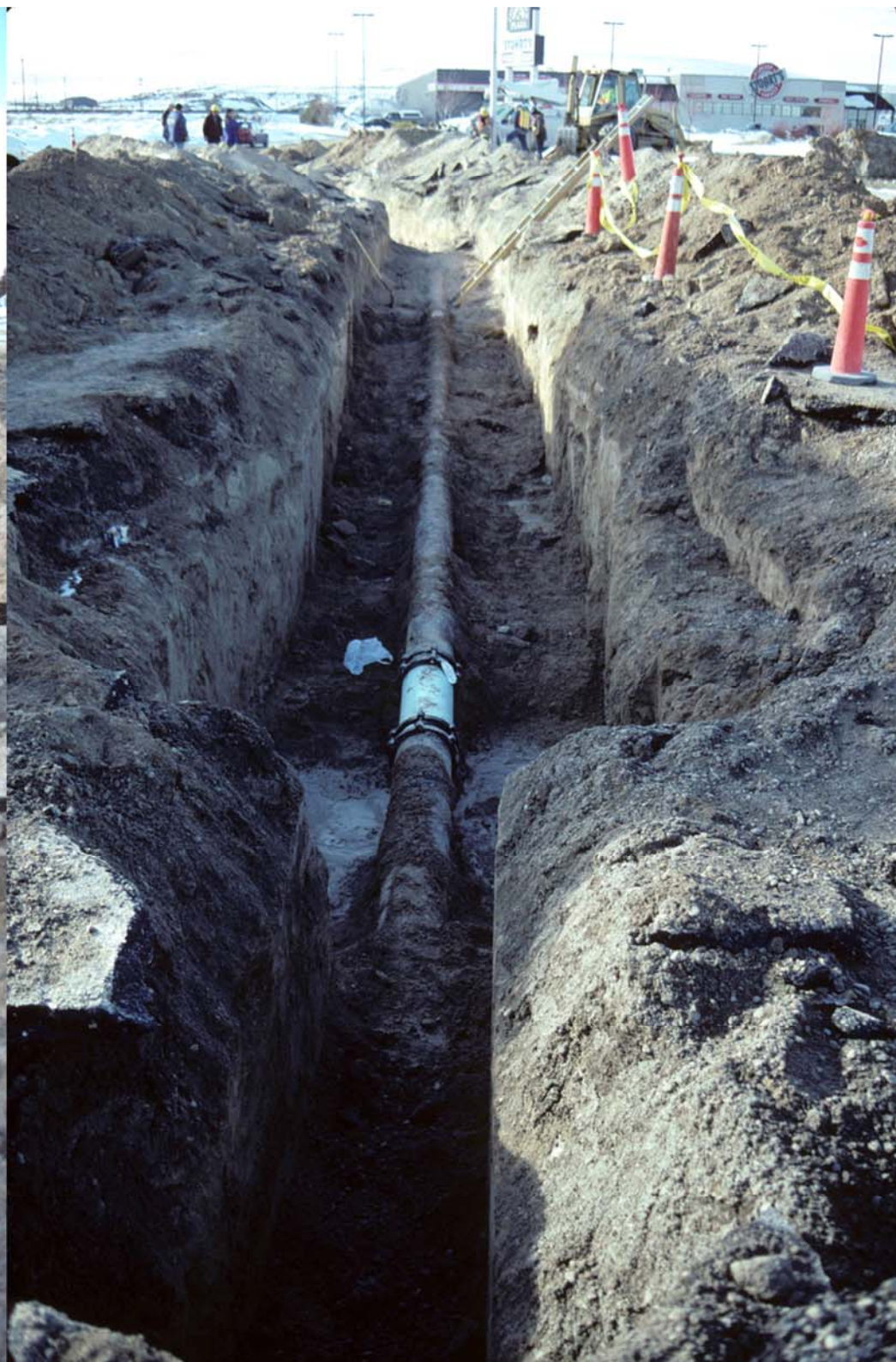


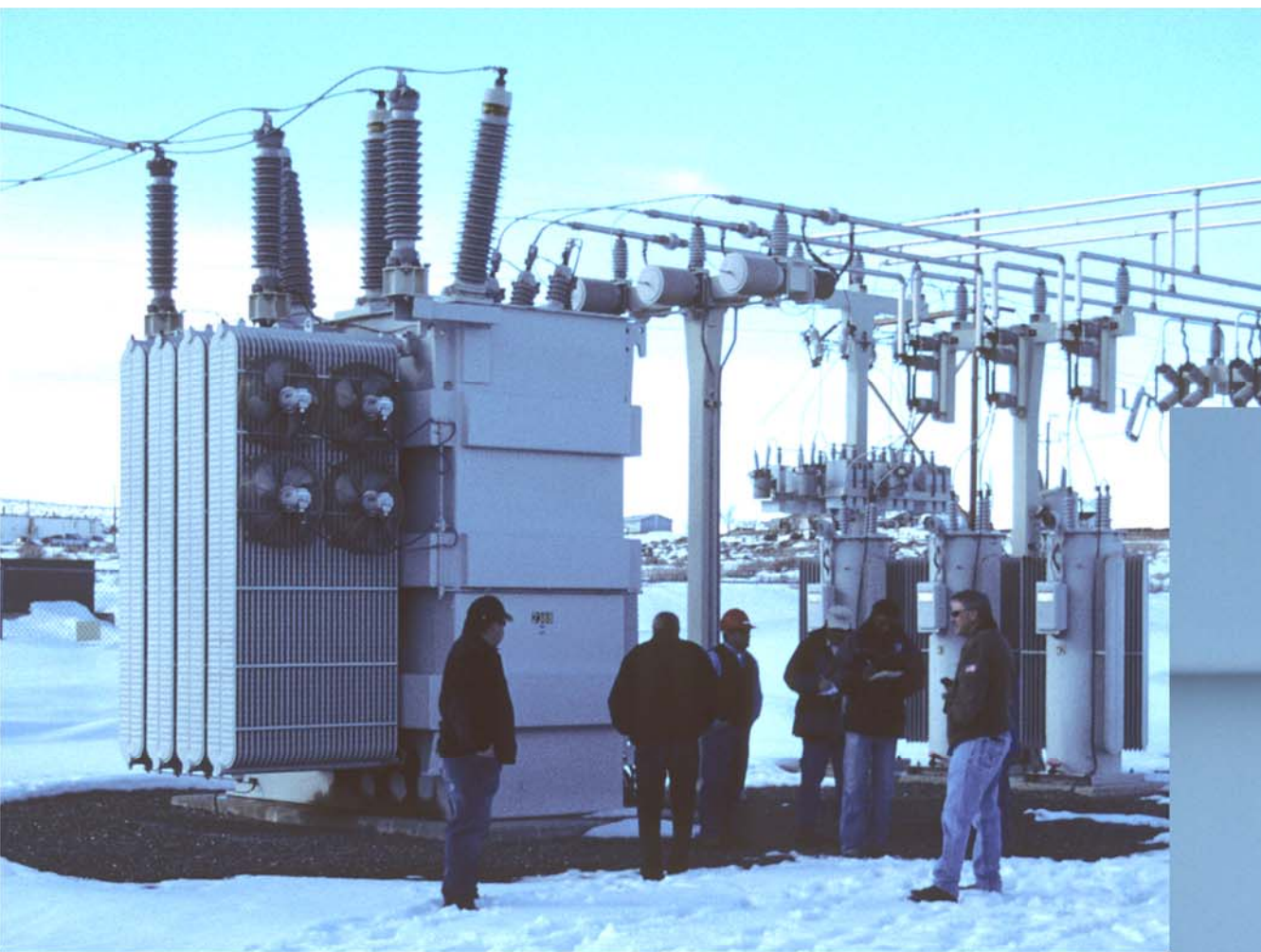




**1 liquid propane leak
2 gas line breaks (w/in house)
1 tank shifted off its foundation**









A program has to be developed in Nevada to **brace and anchor** parapets, crown bond beams, and upper parts of URM walls to give them some seismic strength and keep them from falling.

Enhance balconies and covered walks for protection.

SMALL PROBABILITIES MATTER