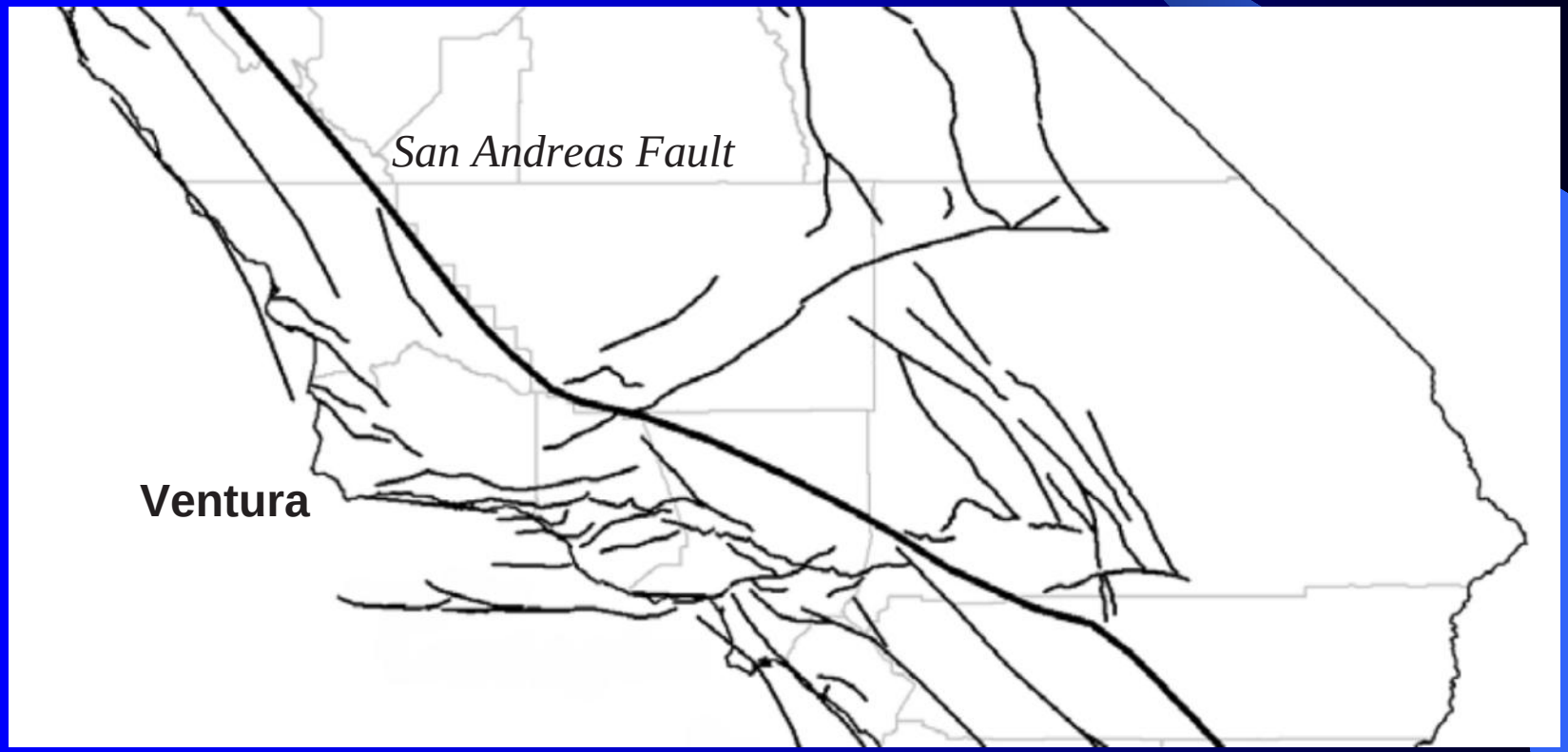
City of Ventura Downtown Commercial Property Owner's Preparedness and Awareness Guide to Earthquake Safety

UNREINFORCED MASONRY BUILDINGS (URM BUILDINGS)

MAJOR EARTHQUAKE FAULTS IN OUR REGION



The Ventura Fault, also known as the Ventura-Pitas Point Fault, is an offshore and onshore Fault system of Southern California, beginning around Santa Barbara and coming onshore in Ventura with an eastward heading; its extension is unknown, but presumed to head for San Bernardino

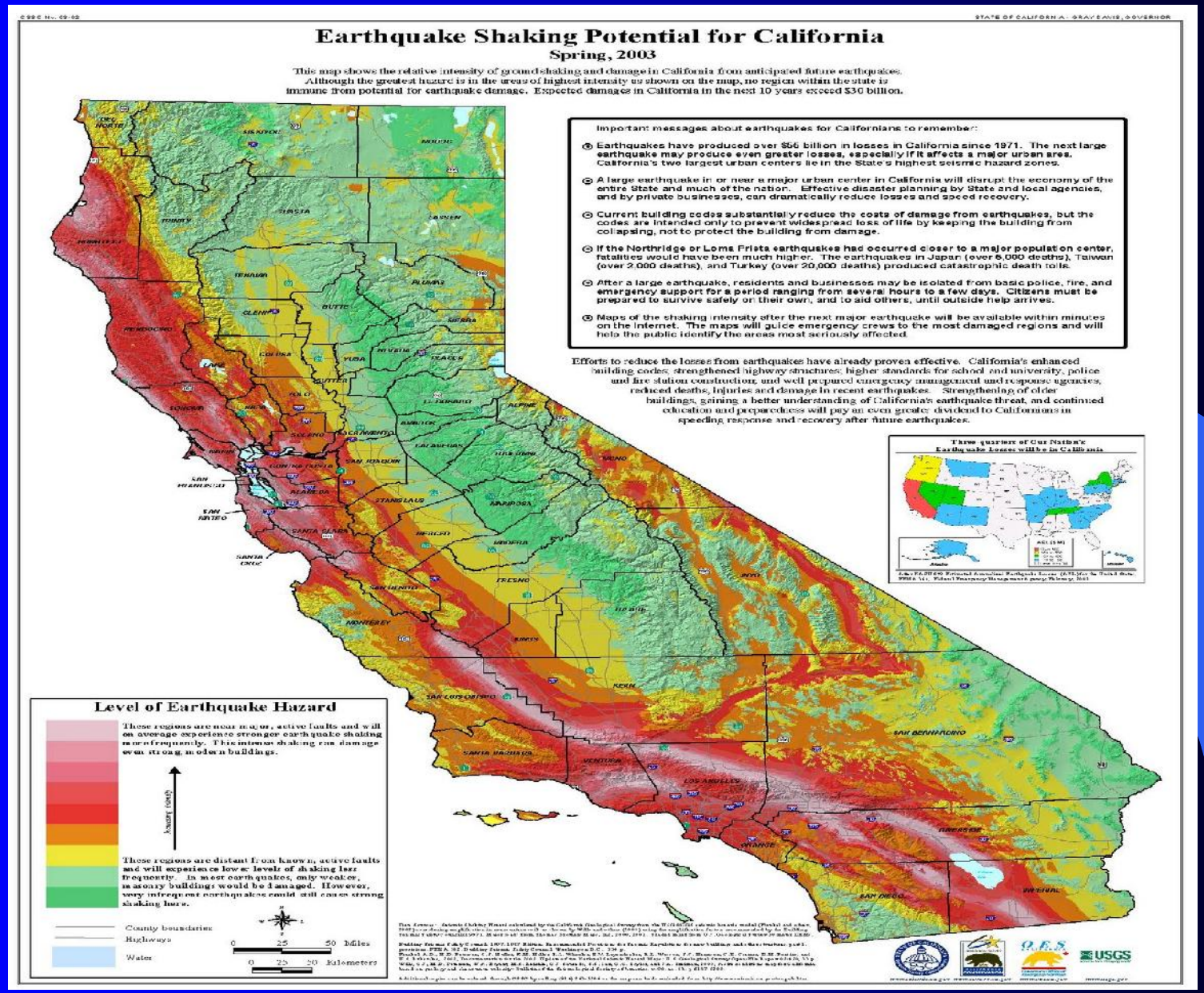
Latest Studies

According to the Los Angeles Times

"Scientists say the earthquake fault that runs through the coastal city of Ventura can produce strong shaking."

New research shows that the Ventura fault is more dangerous than previously thought, capable of producing quakes as large as magnitude 8, as per the Los Angeles Times report on April 20, 2015.

RECENT EARTHQUAKES



1994 Northridge Earthquake

The 1994 Northridge earthquake occurred on January 17, at 4:30:55 a.m. and was centered in Reseda, in the north-central portion of the San Fernando Valley. Its duration was approximately 10–20 seconds. Its magnitude was 6.7, and was felt as far as Las Vegas, Nevada.

Northridge Earthquake, Jan. 17, 1994.
Collapse of the lower, soft story of this apartment rendered it uninhabitable.

Department Store Collapse in Northridge 1994. Fortunately no lives were lost since the earthquake occurred before store hours.

Concrete Parking Structure Collapse at CSU Northridge, 1994

2003 San Simeon Earthquake

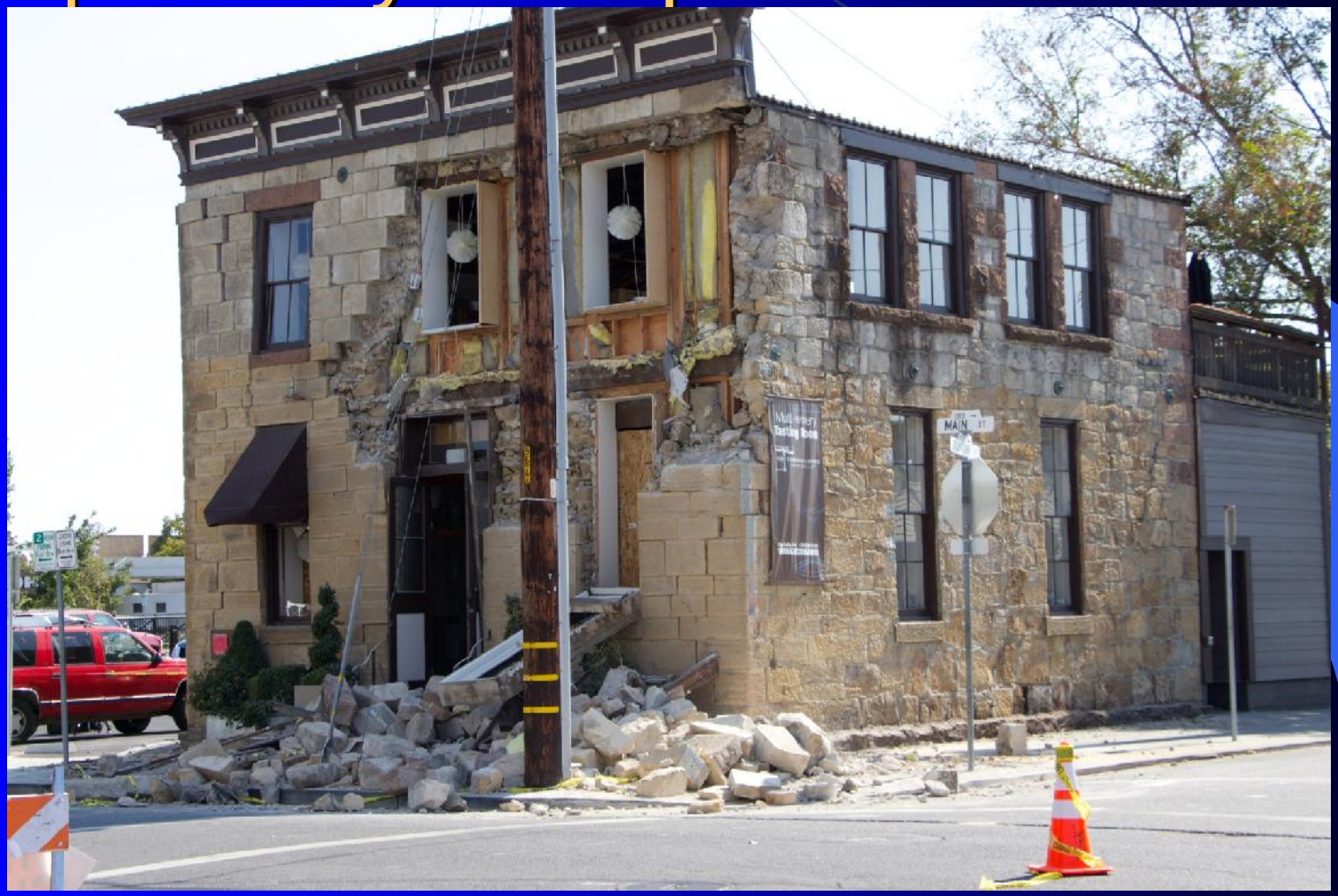
The 2003 San Simeon earthquake occurred with a magnitude of 6.6 on the Central Coast of California, about 7 miles northeast of San Simeon. It occurred at 11:15 a.m. on December 22. The earthquake occurred on the Oceanic fault zone in the Santa Lucia Mountains. The most violent ground movement occurred within 50 miles of the epicenter, though the earthquake was felt as far away as Los Angeles.

San Simeon Earthquake, Dec. 22, 2003
The Acorn Clock Tower Building constructed of unreinforced masonry collapsed.

August 24, 2014 South Napa

The 2014 South Napa earthquake occurred in and around the city of Napa, California on August 24 at 3:20 a.m. measuring 6.0 on the magnitude scale. The epicenter was located south of Napa, approximately 3.7 miles northwest of American Canyon near the West Napa Fault, beneath the Napa Valley Marina on Milton Road, just west of the Napa County Airport.

The Sam Kee Laundry Building after Napa Valley earthquake



Damaged 1875-vintage stone masonry building in Napa. Note wall anchorage (through bolts with steel plates) in this close-up photo

Masonry wall failure in a building retrofitted with wall anchors at roof and floor levels.

ALEXANDRIA SQUARE BUILDING

YEAR BUILT:

-1910

-Listed Historical Building

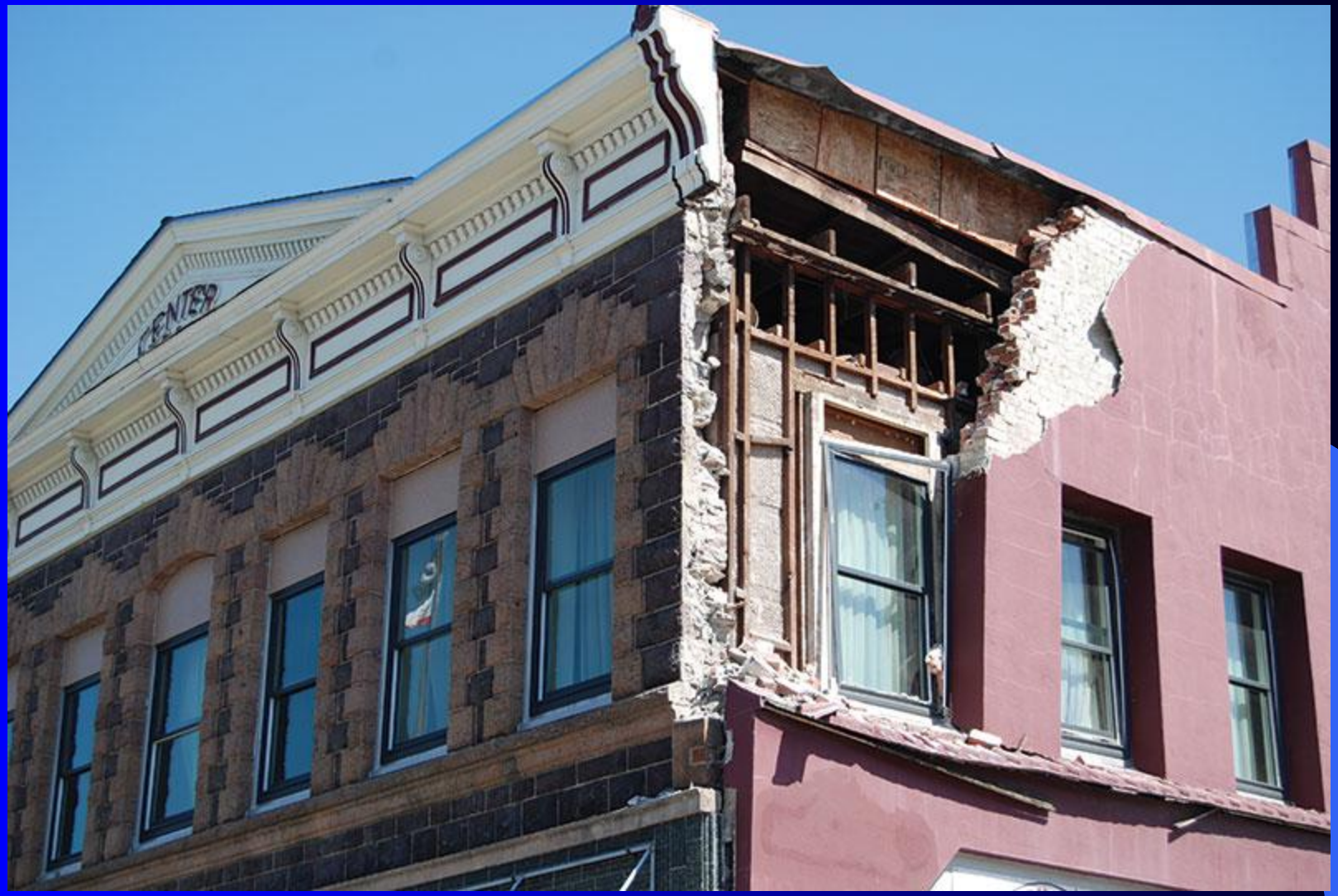
DAMAGE:

-Collapse cupola/tower roof

-Unreinforced Masonry walls on north and west elevations substantially damaged

Earthquake damage to the Alexandria Square building

This three-story structure includes an unreinforced masonry façade, a portion of which collapsed onto the sidewalk below. The close-up photo shows remaining wall anchorage connections below the roofline


CENTER

Like many other California communities, the City of Napa has a URM ordinance which it adopted in 2006. It gave property owners two years to survey and assess their buildings and develop a plan for mitigating the seismic risk, albeit to a less prescriptive standard than for other existing buildings but with the same life-safety goal. Another year was allotted to perform the construction work. In theory, by 2009, the hazard posed by URMs should have been greatly reduced. Many buildings were retrofitted, but many were not because either the building owner lacked the financial resources or because they believed their building was safe despite what the experts said.

Retrofitted URM building that survived the earthquake

Upgrades included wall anchors and a steel braced frame at storefront.

SOUTH NAPA EARTHQUAKE

Magnitude 6.0

Duration:10 to 20 seconds

Estimated damage: $460 million

First weeks:

-234 hospital reported injuries

-All power restored within 2 days

-120 calls for suspected gas leaks

-Over 1,800 calls requesting building inspections

The 6.0 South Napa earthquake serves as another reminder that even moderate events can result in major impacts on local communities and significant losses for key business operations.

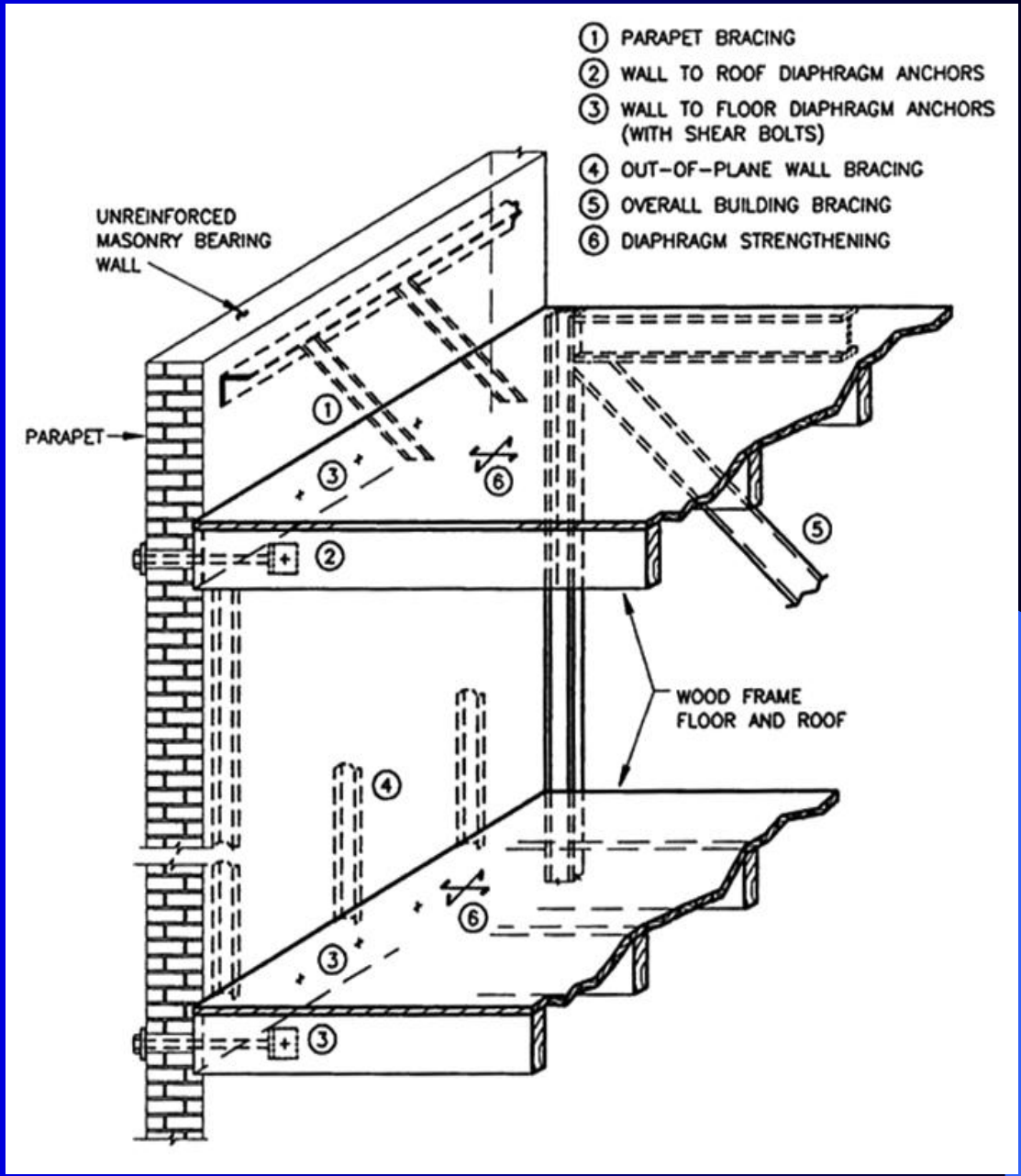
UNREINFORCED MASONRY

Low-rise unreinforced masonry (URM) structures typically consist of brick or stone bearing walls and an interior wood frame. These pre-1930's structures are known to be vulnerable to earthquake damage with safety implications. Typical weaknesses include: brittle wall construction, lack of structural connections between walls and interior framing, weak mortar, slender walls, extensive storefront openings (weak story), and heavy parapets (walls extending above roofline).

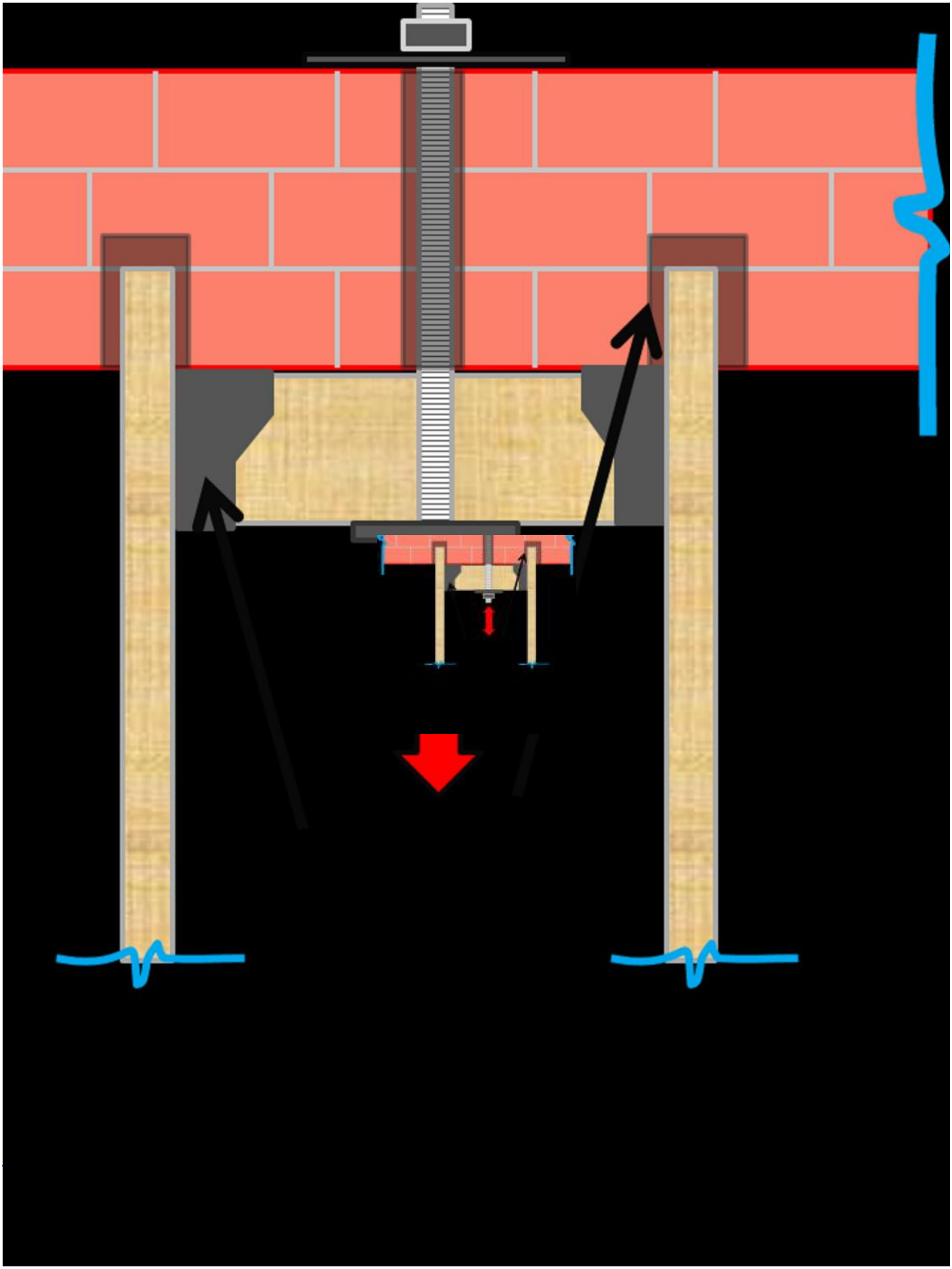
Strengthening unreinforced masonry requires anchoring the walls to the floors and roof, adding interior partitions or walls, installing braces, or other measures. Strengthening will greatly reduce the hazards to life but may not guarantee that unreinforced masonry buildings will be repairable after an earthquake. Unreinforced masonry upgrades require the services of a qualified and experienced engineer or architect.

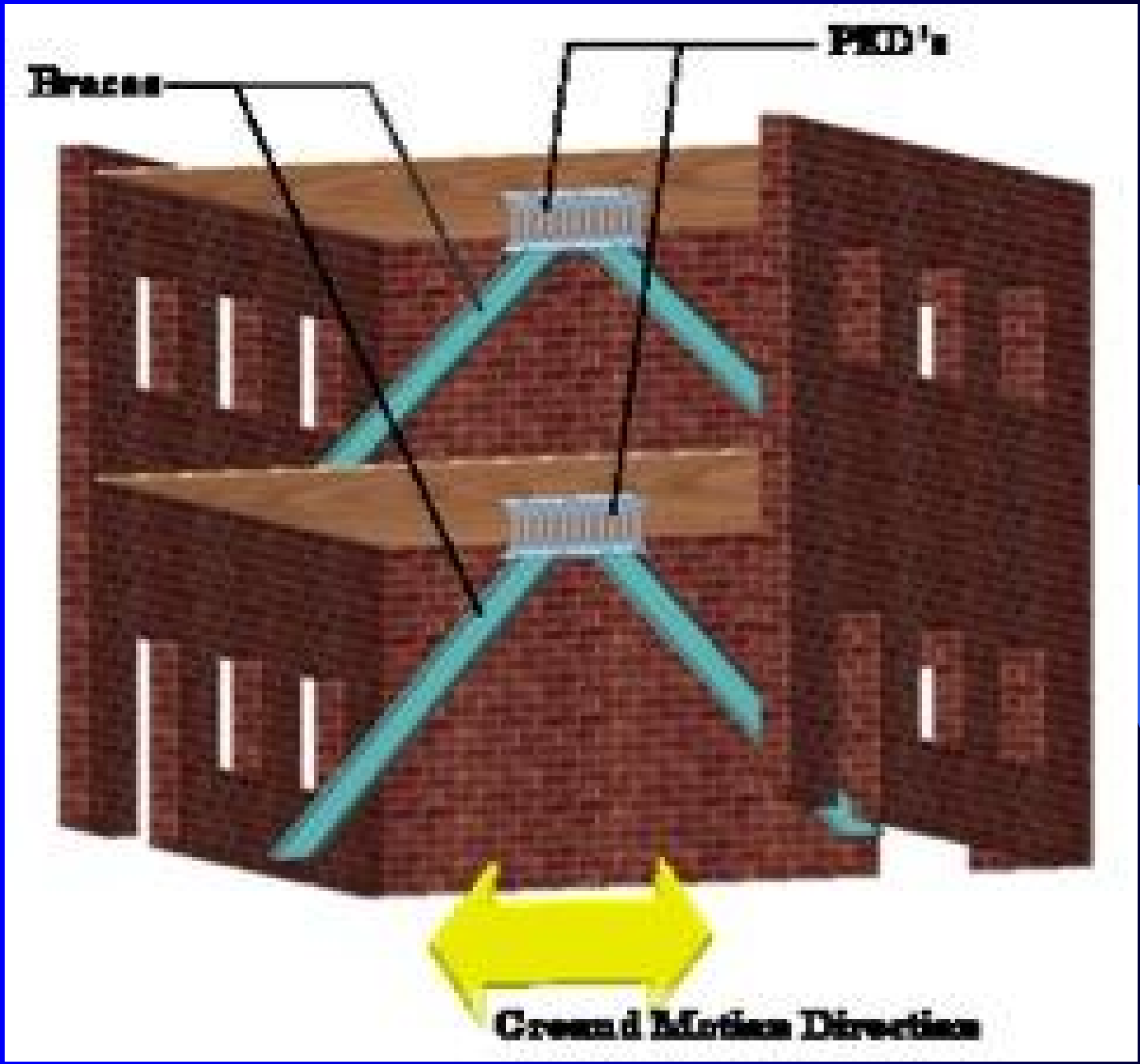
Parapet Bracing:

A lot of damage to URM buildings can be attributed to parapet failures when a seismic event occurs. The damage can occur not only to the building itself, but to nearby buildings, and poses a major risk to life safety. Bracing the parapets is a must when evaluating the needed retrofitting of a URM building.



The URM walls must be tied to the horizontal diaphragms (roof and floor) to increase their resiliency to out-of-plane loading and catastrophic failures. There are many ways to anchor the walls to the diaphragms. Bolting with large bearing plates on the exterior and combining that with epoxy adhesive or grout in the URM wythes, tensile and shear resistance strength is provided for the wall anchor and is one of the most widely used methods.




PSD's
Braces
Ground Motion Direction

CITY OF VENTURA

In 1986, the State Legislature passed SB 547. This law required every local jurisdiction in Seismic Zone 4 (Seismic Design Category E) to identify and establish a mitigation program for all "potentially hazardous buildings" which were defined as buildings that contain walls constructed of brick or other masonry materials and that are not reinforced. Such buildings are commonly called "UNREINFORCED MASONRY BUILDINGS".

1986 The City of Ventura Building and Safety Division conducted an in-depth survey to identify the number of URM buildings in the City.

Original Survey identified 147 URM buildings, with approximately 830,500 SF of floor area, 239 businesses with 590 employees, 97 apartment units and 78 hotel rooms.

In 1988 Building and Safety proposed an ordinance and presented it to City Council. The recommendation was for the seismic upgrade of Ventura's 147 URM buildings. Proposed strengthening requirements were prepared by Structural Engineer John Kariotis based on a seismic hazard analysis.

City Council conducted study sessions and public hearings regarding seismic upgrades of these 147 URM buildings

Survey information, consultant's upgrading recommendations and cost analysis were presented to building owners

1989 City of Ventura hired a consultant, Howard Stup and Associates, to prepare an environmental impact report offering several options for dealing with the existing URM buildings.

After session studies and public hearings in 1991, City Council passed a revised parapet ordinance requiring only minimal seismic upgrades

Ordinance 91-27

Passed and adopted November 25, 1991

Analysis of the stability of Unreinforced Masonry parapets

Investigation and analysis of the attachments of exterior wall appendages

Parapets and exterior wall appendages must be stabilized or braced to ensure that the parapets and appendages remain in their original position if subject to seismic forces specified in Chapter 23 of the Building Code

ORDINANCE 91-27

TIME TABLE

URM buildings fronting Main Street, with addresses in the 100-600 block, and those

URM buildings fronting California Street

3 months minimum time

147 URM buildings in our City were retrofitted to comply with minimum parapet bracing requirements.

Currently, out of those 147 URM buildings approximately 5 have been fully retrofitted

Watermark

Fox Fine Jewelry

In our community, URM buildings showcase community history, provide a visual link to the past, and offer interesting architectural spaces for restaurants, shops and offices. Since it is almost impossible to fully eliminate all risks from URMs, our community needs to reconsider what should be done with these buildings. Many of these buildings are protected historical structures and tearing them down in the interest of seismic safety is less than ideal.

The Napa experience would suggest that improvements need to be made in terms of safety, but that raising the standard too high will result in the strengthening becoming overly costly and visually destroying what makes URM buildings interesting in the first place.