

# More Information on the Pomona Valley (Upland)

## Earthquake

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### INTRODUCTION

A moderately strong earthquake measuring 5.5 on the Richter Scale (M5.5) occurred at 3:43 p.m. on Wednesday, February 28, 1990 at the southern base of the San Gabriel Mountains in Southern California. The epicenter was located approximately 3 miles north of Claremont, California which is situated roughly 30 miles east of central Los Angeles. The earthquake was reportedly felt throughout the Southern California area extending from Santa Barbara in the north to San Diego in the south and as far east as Las Vegas, Nevada.



Although the region immediately surrounding the epicentral area is extensively covered with suburban residential and light commercial development there were no deaths reported and only a limited number of moderate injuries. In the nearby cities of Claremont, Upland, Pomona and La Verne structural damage to buildings was minor, the majority being concentrated in unreinforced masonry (URM) buildings and older residences with URM fireplace chimneys or sub-standard foundations. For buildings and other structures constructed to some level of modern seismic design standards the damage, if any, was

limited to non-structural or cosmetic structural items. Preliminary estimates of the dollar cost of damage to buildings and infrastructure in the entire Southern California area affected were ten million dollars.

### SEISMOLOGY

The main shock occurred in an area known as the Frontal Fault System located along the southern foothills of the San Gabriel Mountains which is criss-crossed by a number of faults that have been active in the past. This event is attributed to one of these faults known as the San Antonio Fault although no surface fractures have been located. It was preceded by an M3.6 foreshock at 12:37 p.m. the same day and followed by a number of aftershocks. The most significant of the aftershocks occurred at 7:24 p.m. the same day with a magnitude of 4.8. The faulting is indicated as being of a strike-slip nature with an epicentral depth of 4 miles. The coordinates of the epicenter have been given as 35° 8' N and 117° 42' W.

A number of strong-motion accelerographs provided acceleration records. These were both free field and structural stations. A summary of the maximum ground horizontal and vertical acceleration values recorded on the instruments installed by the California Strong Motion Instrumentation Program (CSMIP) are shown in the figure.

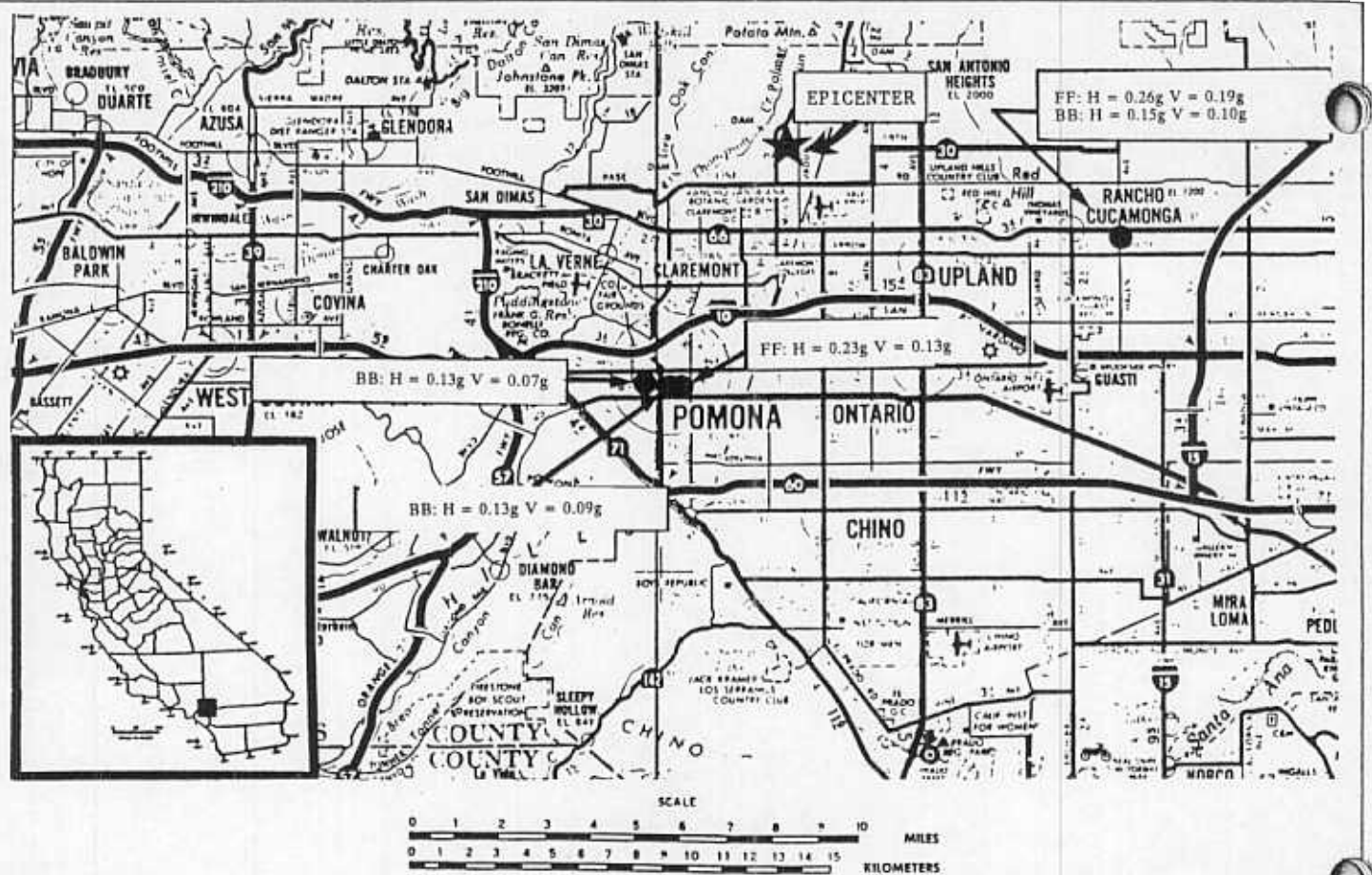
### GEOTECHNICAL

Geotechnical damage was limited to rockfalls and slides on the

steep slopes of the San Gabriel Mountains which resulted in temporary closures of some of the local mountain roads. A 160-foot high earthfill dam, the San Antonio Flood Control Dam operated by the Corps of Engineers, located at the mouth of the San Antonio Canyon and approximately 2 miles northeast of the epicenter is reported to have had 1/4"-wide cracks in the crest of the dam the day following the main shock which widened to 1-1/2" following the aftershocks. The depth of the cracks is about 2-1/2 feet. Some of the cobblestone rip-rap was displaced. The peak horizontal accelerations, as reported by the USGS, lie between 0.4 g and 0.5 g in both the horizontal and vertical directions, at the right abutment, crest and downstream, except for 0.58 g northwards at the crest and 0.83 g vertically at the abutment.

### BUILDINGS

While the area most affected by the earthquake, eastern Los Angeles County and western San Bernardino County, has been under limited urban development for approximately 100 years it is only in recent years that it has been experiencing intensive residential and commercial growth. Because the two counties and the various local jurisdictions have been enforcing building ordinances with aseismic provisions since the mid-1930's, the vast majority of the buildings have been constructed with some level of seismic resistant design. The result is that almost all non-residential structural building damage occurred in URM bearing wall buildings which were



Epicenter Location of Pomona Valley Earthquake and Maximum Measured Ground Accelerations. BB: = Building Basement FF: = Free Field (taken from CSMIP "Quick Report" dated 3-2-90)

located in the older business sections of the communities of Claremont, Pomona, La Verne, Ontario, Montclair and Upland. The remainder of the non-residential building damage in the area consisted of damage to non-structural elements such as window glass, ceilings, partitions and brittle finish materials. Some 110 non-residential buildings were reported damaged, amounting to an estimated loss of three million dollars.

Structural damage to residential buildings was again concentrated in the stock of older units which had sub-standard foundation construction or URM fireplace chimneys. A number of such chimneys either separated from the building or fell on to the roof and in some cases broke

through into the interior. More recently-constructed homes and apartment buildings, the majority of which are wood-frame construction, suffered very little structural damage. Non-structural damage, where it did occur, again consisted largely of broken glass, cracked plaster and broken gas, water and sewer lines. It was reported that 600 homes in the region suffered some degree of damage for an estimated total loss of six million dollars.

It has also been reported that a significant number of trailer homes were displaced from their foundation supports that did not have adequate lateral bracing. The result was some damage to the flooring and considerable damage to the contents.

#### LESSONS LEARNED

Although this earthquake was only moderate in size it once again demonstrated the need for people in earthquake prone regions to prepare themselves to respond to the effects of earthquakes and to work on improving the earthquake resistance of their existing stock of sub-standard buildings and infrastructure systems. Once again the vulnerability of many URM buildings to even moderate level earthquake forces was brought to light. Had this earthquake had the 7.1 magnitude of the Loma Prieta Earthquake of October 17, 1989 there would have been a similar pattern of destruction to that found in the cities of Santa Cruz and Watsonville.