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All reservoirs leaked; two could not be repaired. Many underground gas and waterlines were separated, buckled, or fractured. Nearly every pipeline in the major ground rupture zone was damaged. All telephone equipment in the Sylmar Central Office of the General Telephone Company (Polk St. and Borden Ave.) was totally destroyed. Damage to the building and equipment was estimated at \$4.5 million. In the Sylmar area, many pole transformers were thrown down; insulators and crossarms were broken; wires and poles were knocked down; and cable was sheared off in underground ducts. Four gas transmission lines, ranging in diameter from 30.4 to 66.0 cm., were damaged between Newhall and San Fernando, resulting in loss of gas supply to the San Fernando-Sylmar area. A main feeder gasline (40.6 cm. in diameter) broke and erupted in flames on Glenoaks Boulevard between Hubbard and Bledsoe Streets, shutting off service to 20,000 homes. Oil field facilities and related structures sustained minor damage to tanks, roads, pipelines, and a few wells in Aliso Canyon, Cascade, Newhall, Newhall-Potrero, Oak Canyon, Placerita, and Ramona Oil Fields.

#### Damage to Other Structures:

San Fernando Veterans Administration Hospital: Major collapses of older unreinforced masonry buildings occurred at this complex facility. Forty-nine were killed; many were injured.

San Fernando Valley Juvenile Hall Facilities: Severe and extensive damage occurred to practically all buildings; one collapsed. Buildings were evacuated. Fissures about 45 to 60 cm. wide and about 1.2 to 1.5 m. deep were observed at this site.

San Fernando Industrial Tract (east of intersection of Foothill Blvd. and Arroyo St.): Most structures were posted as unsafe. Severe ground cracking, lurching, and compression-ridging occurred at this site. Sidewalks were torn up and buckled.

Sylmar Industrial Tract (east of San Fernando Road in Bledsoe and Bradley areas): Most buildings were posted as unsafe. Many roofs and walls collapsed. Considerable ground cracking and compression-ridging occurred.

Foothill Nursing Home (just east of Foothill Blvd. and about 0.5 km. south of San Fernando Ranger Station): The building, a one-story concrete block structure, was damaged severely. The curb and sidewalk in front of the building was raised about 0.9 m. by surface faulting that also passed under the building.

Holy Cross Hospital (southeast of Lower Van Norman Lake): Major structural damage occurred to this seven-story reinforced concrete building. Extensive and severe cracking was observed. Also, the nearby Indian Hills Medical Building was damaged badly.

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Pacoima Memorial Lutheran Hospital (about 2.8 km. southeast of Foothill Nursing Home): Major structural damage was sustained to four-story reinforced concrete building.

### Schools:

The following is from a report by California Institute of Technology<sup>2</sup>: "Most schools in the San Fernando Valley were post-1933, and these experienced little damage from shaking. Some wood frame buildings were shifted on their foundations, and some cracking was experienced. The foundations of several school buildings, such as Van Gogh School and Sylmar High School, were disrupted by permanent ground displacements, but structural damage was not such as to constitute any undue hazard to occupants. However, in some cases, light fixtures and ceilings, supposedly designed to withstand earthquake shaking, fell and these would have been hazardous. The generally good behavior of the school buildings in the San Fernando Valley is due mainly to the fact that they were well constructed one- and two-story structures, mostly wood frame and plaster, that were significantly stronger than the minimum requirements of the building code. Of the pre-1933 schools, Morningside School at Maclay Avenue and Fifth Street in San Fernando was closest to the center of the earthquake. One of the two structures at this site was a good quality, two-story brick bearing wall building (1928) which was very badly cracked by the ground shaking. Although it would not have injured occupants during the earthquake, it did appear afterwards to be in a most dangerous condition, and it has been demolished. Since the earthquake, most of the old buildings have been closed. A few were judged to be in a good condition and not unduly hazardous to the occupants, and these will be used for a limited period of time."

### Private Dwellings:

Severe and extensive residential damage occurred in the area of permanent ground displacement, beginning in the area of Glenoaks Boulevard and Hubbard Street and extending east across northern San Fernando (north of Maclay Ave.) and on into the foothills to the east. Many houses, including mobile homes, were cracked very badly and shifted from foundations. Many one- and two-story apartment buildings also were damaged extensively. Another area of severe and extensive damage to residential houses was between the Olive View Hospital and the Veterans Administration Hospital where some residences were damaged beyond repair and some were in a state of collapse; many shifted off foundations. Practically all concrete block walls and chimneys fell. Also, many dwellings in various states of construction in the area east of the Veterans Administration Hospital were damaged heavily; some collapsed.

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The majority of the following reports were obtained through the questionnaire card canvass:

San Fernando:

2043 Phillippi Street (northwest corner of San Fernando, about 2.7 km. southeast of Olive View Hospital). Felt by, awakened, and frightened all in community (observer sleeping in 25-year-old, well-built, one-story wood frame building). "I was awakened by roar just before shock and was on feet when it hit. No one sound could be distinguished. The building and everything in it shook so violently that the combined sounds were deafening. In my block, streets split and were displaced in about 10 places; one place in street was buckled. Other streets in the area were split, cracked, twisted, and buckled far worse than my street. My chimney top shot straight up, then fell on the roof. It was pulled straight up, with its reinforcement rods left in main body of chimney. Swimming pools in the area lost 5,000 gallons or more of water. One pool, two blocks away, was pushed under decking nearly to the house foundation. All bedroom furniture in three bedrooms, except beds, was overturned. Every bottle lid was screwed off or loosened, even new bottles. Eighty-five percent of glass and pottery broken, even 'melmac.' Moderate-to-severe plaster cracks in walls and ceilings of every room. Ninety-nine percent of block walls down, including reinforced walls. I have only slight damage to my house, but half a block away, every other house is condemned; one block away, 90 percent of the houses are condemned. All water-pipes and many gaspipes had to be replaced in a 36-block area of San Fernando where I live." Ground: Compact soil over bedrock, no fill.

1942 Chivers Street (northeast of Glenoaks Blvd., about 3 km. south of Olive View Hospital). Felt by and awakened all in community; frightened all in 20-year-old, well-built, one-story wood frame building. "Couldn't distinguish earth noises from building noises." Trees and bushes shook; vehicles rocked. Ground cracked; landslides; water disturbed. Chimneys, tombstones, elevated water tanks, etc., cracked, twisted, and overturned. Hanging objects swung violently. Small objects shifted, overturned, and fell. Furniture shifted, overturned, and broke. Plaster cracked. "Ground fractures. Waterlines and gaslines broken in street. According to the U.S. Geological Survey, the lot was shortened by about 0.3 m. Most concrete block fences knocked down." Damage moderate to house. Ground: Gravelly, sloping.

Foothill Boulevard and Vaughn Street (about 0.8 km. east of San Fernando Airport). "Building about 6 months old. Floor is up and down 0.3 m. near rear of the building. Side walls torn loose from glu-lam beams. Rear lintel broke. Front wall (S-W) looks good. Waterpipe in street (0.6 m. in diameter) broke."

12300, 12314, 12424 Gladstone Avenue (northeast of Foothill Blvd., about 0.8 km. northeast of San Fernando Airport). "Building (concrete tilt-up) at 12300

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Gladstone moved 0.3 m. into building at 12314 Gladstone, ground and all, at west corner. This was possible because it sat back about 0.3 m. behind adjoining building. The 12314 Gladstone building (concrete block) was only moved 10 cm. off footings at west corner. Floor distorted badly. Compression lines in rear yard running north-south. Building about 3 years old. Street buckled. At 12424 Gladstone (building about 1 year old), northeast rear wall failed because nails pulled through 1.27-cm. plywood roof diaphragm. Nails also pulled through plywood on southwest wall. Southwest block wall, supported by frame and stucco office in front, did not fail, but front block corners were completely broken. Building leaning about 7.6 cm. to west. Diagonal east-west cracks, about 2.5 cm. wide, in floor."

12401 Filmore Street (Filmore St. and Foothill Blvd., northeast of Glenoaks Blvd., about 1.6 km. southeast of San Fernando Airport). Felt by, awakened, and frightened all in community (observer sleeping in new, well-built mobile home). Loud earth noises. Trees and bushes shook; vehicles rocked. Small objects fell. Furniture overturned and broke. Plaster broke and fell. Windows cracked. Ground cracked; landslides; water disturbed. Chimneys overturned. "Mobile home, 18.3 by 6.1 m., weight 11 tons (with wheels off), moved 1.2 m. and was broken apart. Waterpipes and gaspipes in ground were twisted and broken. All dishes and glassware broken; food thrown from refrigerator; all closets emptied of contents; locked doors came open. Noise was overwhelming. Personal feeling was one of resignation to the inevitable--surprised to be alive after shock was over. Also, complete panic after the shock was over due to no communication. Learned later that a fault was located about 61 m. from our home." Damage great. Ground: Compact.

Glenoaks Boulevard, southeast of Hubbard Street (Brown's contracting yard). The following is from California Institute of Technology report<sup>2</sup>: Heavy lathe moved 2.7 m. in northerly direction, leaving straight skid mark. Locomotive (1880 vintage), standing on rails and ties in yard, overturned.

### Sylmar:

13151 Chesterwood (near Gladstone Ave., east of Foothill Blvd.). Felt by, awakened, and frightened all in community (observer lying down in well-built, one-story wood frame building). Motion rapid, rippling, thrusting; direction up and down and north-south, with small east-west movement; 30 seconds of strong motion, 15 minutes of moderate motion. Loud, cracking and roaring earth noises, sounded like noise made by a jackhammer. "I was 30 seconds inside and 5 to 15 minutes outside." Hanging objects swung north-south. Trees and bushes shook moderately. Small objects and furniture overturned. Dishes and furniture broke. Plaster, walls, and chimneys cracked. Chimneys, columns, and monuments fell. Damage slight to wood; considerable to brick. Cracks in roads; about 0.9 to 1.2 m. of thrusting. "Many cracks in roads and pavement. Some houses condemned but most wood frame and stucco houses

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survived with little damage. Most brick walls were down. Freeway bridges collapsed." Ground: Rock, clay, and sand, level.

12939 Gladstone Avenue (near Gridley St., east side of Foothill Blvd.). (VIII)

Felt by, awakened, and frightened all in community (observer walking in old, well-built, wood frame and stucco building). Felt as if a bomb had exploded. Loud and instant earth noises. Vehicles rocked; car shifted. Ground cracked; landslides; water disturbed. "Landslides in the hills." Chimneys and water tanks cracked, twisted, and overturned. Hanging objects swung violently. Small objects shifted, overturned, and fell. Furniture shifted, overturned, and broke. Plaster and windows cracked. Lights out. Damage moderate to great. Ground: Some rocky; mostly alluvial clay soil.

13321 Gridley Street (near Gladstone Ave., Maclay Rancho Section). (VIII) Felt by all in community; frightened all in well-built, one-story wood frame and stucco building (observer lying down). Moderate rumbling earth noises. Ground cracked. Reinforced concrete block chimney had to be demolished. Hanging objects swung violently in circular direction. Small objects overturned and fell. Furniture overturned and broke. Stucco cracked; plaster cracked and fell. One window cracked. House off footing; door sills, window frames out of line. "House first lifted and settled, then rolled from side to side. All cupboard doors opened, spilling contents on floor. Furniture against wall toppled; furniture standing free did not fall. Attached garage is on slab; slab cracked and separated from house about 2-1/2 to 4 cm. One exterior wall out of line; one chimney wall demolished." Damage great. Ground: Compact, sloping.

13972 Sayre Street (between Borden Ave. and Foothill Blvd., near Phillippi Ave., southwest of Foothill Blvd.). (VIII) Felt by, awakened, and frightened all in community (observer walking). Very loud earth noises. Trees and bushes shook; vehicles rocked. Ground cracked; landslides; water disturbed. Chimneys, tombstones, elevated water tanks, cracked, twisted, and overturned. Houses off foundations; cement slabs cracked in half and spread. Hanging objects swung violently north-south. Small objects fell and broke. Furniture shifted, overturned, and broke. Windows cracked. Damage moderate. Ground: Gravel and clay, compact, level.

14141 Foothill Boulevard (about 1 km. southwest of Olive View Hospital, near Polk St.). (VIII) Felt by, awakened, and frightened all (observer sleeping in old, one-story wood frame and stucco building). Roaring earth noises. Vehicles rocked. Ground cracked; landslides; water disturbed. Tombstones, elevated water tanks, cracked, twisted, and overturned. Pipes broke. Hanging objects swung violently northeast-southwest; objects fell in various directions. Small objects thrown. Furniture shifted and overturned. Plaster cracked, broke, and fell. Wall moved. Hot water heater torn from wall. "All animals panicked; horses broke corrals. The earthquake shook, rolled, and heaved. Fires broke out everywhere. All birds left at dawn before the shock hit." Ground: Sandy loam, level.

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13477 Bradley Street (northwest Sylmar area, between Roxford St. and Foothill Blvd.). (VIII) Felt by and awakened all in community; frightened many; all in 12-year-old, well-built, wood frame and stucco building. Hanging objects swung violently. Small objects overturned. Furniture shifted. "There were so many sounds it is impossible to describe them. All I can say is that they were very violent. Limbs on my trees were shaken off. My block wall fell. Vehicle moved about 0.6 m. In the community, there were many chimneys down and some houses were off foundations. Little plaster cracking in my home; no windows cracked. Damage to my home was slight." Ground: Compact soil, level.

15445 Cobalt Street (west Sylmar area, south of Roxford St., near San Fernando Rd.). (VIII) Felt by, awakened, and frightened all in community (observer lying down in new, well-built, metal mobile home). Loud earth noises, like those made by a train. Trees and bushes shook; vehicles rocked. Ground cracked; water disturbed. Chimneys and tombstones overturned. Hanging objects swung violently east-west. Small objects overturned. Furniture shifted. "I was never so frightened in all my life. I have never been a nervous person, but during these last 2 months I get scared at the least little movement. I know I'd rather be in a mobile home than a house during an earthquake. I was at work during one of the aftershocks and it was worse than the first shock--the building rocked and swayed, and I was very frightened." Damage slight at mobile home. Ground: Gravelly, sloping.

14343 Berg Street (near Glenoaks Blvd., north of Sayre). (VIII) Felt by, awakened, and frightened all in community (observer sleeping in 14-year-old, well-built, one-story wood frame and stucco building). "All noises blended into one loud, rumbling roar." Trees and bushes shook; vehicles rocked. Ground cracked; water disturbed. Walls fell. Gaslines broke. Hanging objects swung violently in all directions. Small objects shifted, overturned, and fell; all dishes fell to floor. Furniture shifted, overturned, and broke, such as chest-on-chest dresser. Plaster cracked, broke, and fell. Window broke. "Building sound as far as known." Ground: Compact, level.

13597 Simshaw Avenue (about six blocks south of the southeast boundary of the Veterans Administration Hospital grounds). (Excerpted from a letter to Robert D. Nason, Earthquake Mechanism Laboratory, ERL, NOAA) (VIII) "The first shock was sudden; no warning rumble. I thought it was an explosion. We went up and down, with the noise and jolts accelerating. I can recall four very hard up-and-down motions, the last one being the hardest. The sound seemed ear-splitting--I thought my eardrums would burst. It was impossible to hear anyone, so we just didn't bother. My daughter said she was screaming but not one of us heard her. My husband, a large, strong man, tried to force himself up from the bed but was slapped down each time. Five times he tried, straining with every muscle, until he was exhausted. I had trouble hanging onto the bed. We could hear nothing but the noise of the earthquake. The slapping motion of the earth seemed to be in an east-west direction, with the last slap ending

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in a hard motion to the west, toward Olive View Hospital. We were shaking between the up-and-down motions. Now we started to roll. I was holding on to the bed for 'dear life' to keep from being thrown into the furniture. I could see the clock glide across the room. I looked out the window from the bed. The window starts at about 1.5 m. from the floor and goes to about 0.45 m. from the ceiling. I could clearly see the outline of the trees against the sky (it is a 360-acre area, rather open), the tops of the trees, the sky, the dark area of growth, and the very dense area--I expected to see the ground any minute. This was repeated with every roll. At one point I thought the house would go over with the next roll as each roll was worse than the last. That, I believe, was the end of the major motion, as my husband and I jumped out of bed almost simultaneously. It was when we were in the rolls, north-south direction, that I could hear everything falling and breaking. The 'slaps' felt as if one were being blown around and up in the air, then coming down hard, like being in the center of a big explosion. The concussion was unbearable. During the rolls the sound was much more bearable. When we got to the bedroom door we found it was jammed with furniture, including the heavy dresser and the sewing machine, which was upside down. The minute I could get a few centimeters gap in the door, I yelled to my children to get outside, and not to wait for us. My husband had the door cleared in seconds. My four children were huddled in the hall. We were now in the aftershocks. The hall was leaning in first one way, then another. We pushed the children down the hall. We were thrown against each side of the wall all the way to the front door. Then came another hard aftershock, and my husband could not get the door open. As the shock eased, he was able to jerk the door open, bending the middle hinge badly. We were the first ones out on our street. We stood on the lawn and watched Pacoima Dam light up with a hazy glow and then fade. The light came from behind the front of the dam and was a steady light, not a flash. There were lots of slides and dust. We could hear lots of large rocks rolling down off the dam area, and thought the dam was breaking. We left the children in the car, which was bouncing up and down with every shake. By now, people were starting to come out of their houses. I just sat in the middle of the yard, I was so dizzy and dazed. The ground was bumping up gently, and I noticed that I was sitting on one of the cracks in the yard but I just didn't care. I saw people who looked simply frightened 'out of their lives' and some who looked absolutely blank. We felt as though we had been through an explosion. It wasn't until we were in the aftershocks (in the hall) that I suspected it was an earthquake. We returned to the house a minute or two at a time to gather shoes and robes. It took us 2-1/2 hours to find my husband's glasses even though he knew where he had left them. At daylight, we were amazed to find the house structurally intact, as we had been thinking it would be totally ruined. Inside, however, it was a mess, taking over 3 weeks to straighten it up. The house has a slab floor and drywalls, and stood up well. We had about \$181 in structural glass

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damage, even the shower doors were broken. Our neighbors on both sides of us were not so lucky. In general, things were scattered in a very even pattern throughout the house. I took a straight pin, which was embedded about half way in, out of my bedroom wall. I have written down most of the details as I remember them and given a lot of thought to them, trying to be as exact as possible, if anyone could be exact through it. I asked my doctor how Pacoima Lutheran Hospital was and he said, 'Bombed!' Somehow that just explains things perfectly."

22117 Sierra Highway (about 5 km. northwest of Sylmar). "All other earthquakes that I have experienced were of a rolling motion, but this one felt as if the bottom fell out of everything. I felt a falling sensation, and jumped up to try to get out, but I was knocked down to my knees. I was sitting at the kitchen table when it struck. Everything began to fall; all dishes and glassware crashed to the floor; then in about 5 seconds the light went out. I finally got to my feet, after about 30 seconds, and yelled to my wife to hurry down so we could get outside. If we had been sitting on a big vibrator, it couldn't have shaken us any harder. There was no rolling or horizontal motion. It was a straight-up-and-down motion. A big bookcase and a large commode upstairs fell toward the east. There was no noise as in other earthquakes I have experienced. This one hit without warning. This old house was built in 1915 and is on pretty solid ground. My service station across the street from me was not damaged. About 0.8 km. south of me, near that new freeway that was being built and where so many bridges were lost, there is a mountain that is torn all to pieces--looks as if it went through a grinder. The north side of my house didn't seem to get hit as hard as the south side."

Kagel Canyon Area:

12587 N. Dexter Park Road (Los Angeles Fire Station No. 74, about 5 km. southeast of Veterans Administration Hospital, in sec. 32, T. 3 N., R. 14 W.). Felt by, awakened, and frightened all in community (observer sitting in old, well-built, one-story wood frame building). Building made loud snapping sound. Loud earth noises, similar to noise of jet plane. Trees and bushes shook; vehicles rocked. Ground cracked; landslides; water disturbed. Chimneys, tombstones, elevated water tanks, etc., cracked, twisted, and overturned. Gas main broke; power off. Hanging objects swung violently in various directions--east-west, north-south, all directions; also strong vertical motion experienced at this location. Small objects shifted, overturned, and fell; furniture shifted, overturned, and broke. Plaster cracked, broke, and fell. Windows cracked. "This building was moved off foundation approximately 0.3 m. and had to rise over sill at least 11 cm. to settle down without damage to shingles." The following is an excerpt from a report by B. J. Morrill<sup>5</sup>:

"Firemen were resting in the wood frame quarters building . . . Mr. J. White, duty fireman, stated that he was tossed out of bed onto the floor



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and the bed landed on top of him. Every object in the building was upset. Even the handset of a standard wall phone came off its hook. Loud, cracking and thunderlike noises added to the general confusion. The building was shifted off its foundation. Outside, rocks were thrown off the ground, and large cracks appeared in both soil and rock . . . many ground cracks appeared throughout the area. The surface of a hill adjacent to the building exhibited the 'shattered earth' effect reported . . . a few miles to the west. A nearby rock roadcut appeared to have exploded, and the adjacent road was offset in many places . . . A 20-ton fire truck in the garage . . . moved 6 to 8 feet fore and aft, 2 to 3 feet sideways without leaving visible skid marks on the garage floor. The truck was in gear, and the brakes were set. Damage to the truck was a bent rear step, broken windshield, shattered red light, and siren broken off. Also, a ladder and a hook were broken. Marks which appear to have been made by the right rear tire were found on the door frame . . . 3 feet above the floor, while the metal fender was not damaged. The fender extends several inches out beyond the upper portion of the tire. Four feet above the floor the hose rack was broken by the rear step of the truck. The step was bent up while the hose rack was broken downward. The rear of the garage was pushed outward 6 to 8 inches, and the final position of the truck was about 4 feet out the front of the garage, with the garage door resting on the cab." Morrill also suggests that the building accelerated upward, with respect to the ground, at a rate of at least 1 g. for about 0.1 second.

12557 Kagel Canyon Road. Felt by, awakened, and frightened all; general panic (observer sleeping on second floor of 10-year-old, well-built, two-story wood frame and brick building). Felt like an explosion. Loud earth noises. Ground cracks; landslides; water disturbed. Chimneys, tombstones, and elevated water tanks cracked and twisted. Masonry shattered; wood twisted. Hanging objects swung violently in all directions. Small objects fell; furniture shifted, overturned, and broke. Plaster cracked and broke; windows cracked. Damage moderate to great. "Many aftershocks." Ground: Sandstone, fill, hilly, sloping, and level.

11825 West Trail (south Kagel Canyon). Felt by, awakened, and frightened all in community (observers sitting and standing in old, well-built, one-story wood frame building). House moved northeast-southwest in bucking motion and made nail-pulling sounds. Loud earth noises, like noise of low-flying jet plane. Trees and bushes shook; vehicles rocked. Four ground cracks around house, three about 2.5 cm. wide and one about 10 cm. wide; ground raised in several places. Ten-cm.-wide cracks in 0.3-m.-thick walls. Retaining walls fell. House full of plaster cracks. Stucco walls cracked. Foundation broken in two places. Hanging objects swung violently northeast-southwest and up and down. All items fell from cabinets. Most small objects fell and broke or were ruined by fluid. Furniture shifted, overturned, and broke; refrigerator on rollers moved; one old refrigerator overturned. Damage moderate. "Husband heard the shock coming. Hard rattle at first, then in 1-2 seconds I was thrown from chair and my husband was dumped into the tub; then back-and-forth motion. I was able to reach

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the hall and get the children under a doorway until things slowed down, then we went outside. Lights went out in the first movement. Water out but gas and telephone OK. Ground seemed to keep moving. We have 3 acres (San Gabriel Range, first mountain by valley) with three houses. Lower house had little damage; no landslides or broken pipes. The second house, about 38 m. or so higher up, had cracked foundation; 0.3-m.-thick walls cracked 2.5 to 10 cm.; four deep ground cracks, two under the house. Third house, about another 30 m. higher up than the second house, had cement floors buckled and cracked; deep ground cracks; pipes separated; new garage (side room) separated from house and slightly askew; 1.9-cm. floor crack in cement; door wedged closed; everything dumped from cabinets, and lots of stored glass windows broken. Water main in front of this third house was broken in five places."

13706 N. Kagel Canyon Road. Felt by and awakened all (observer sleeping in new, well-built, one-story concrete block building). Building made snapping sound. Loud earth noises. Trees and bushes shook; vehicles rocked. Ground cracked. Chimneys cracked. Water tank off foundation. Fifteen m. of natural stone wall, running west-east, fell. Hanging objects swung violently east-west. Small objects fell and broke. Furniture shifted and overturned in all directions and broke. Plaster cracked. Damage moderate. Ground: Rocky, compact, sloping. "My husband was awake and was thrown from north to south. Furniture was overturned from north-south, east-west, and west-east. Refrigerator was out of position from south to north about 46 cm. Kitchen cabinets, from both north and south shelves, were almost emptied. In living room, articles on north end of room slid off tables toward north, and on south end of room all books were dumped onto the floor from west to east. Most violent action seemed to be from east to west, from final position of furniture."

Kagel Canyon. The following was excerpted from a letter by Doreen Russell, Secretary, Kagel Canyon Civic Association: "Many of our homes have been totally destroyed, while others just next door had no real structural damage. For example, our home had very slight damage, but two of our immediate neighbors, one (who owns) a very new house and the other a much older structure, lost their homes. Severe ground scarp at Glen Haven Cemetery."

Karl Holton Boys Camp (about 5.6 km. southeast of the Veterans Administration Hospital, in Marek Canyon, branch of Little Tujunga Canyon). Extensive damage to buildings. Forty-six m. of 4.3-m.-high concrete block wall collapsed. Extensive landsliding and ground fracturing. Severe structural damage where ground cracks passed through or adjacent to the buildings. The camp was evacuated.

Little Tujunga Ranger Station (12371 N. Little Tujunga Road, about 0.8 km. south of Karl Holton Boys Camp). (Report from Hugh E. Masterson, District Fire Control Officer.) Felt by, awakened, and frightened all in community; general panic (observer lying down in well-built, one-story concrete block building). Loud earth noises. Ground heavily fractured. Water tank twisted. Concrete cesspool, waterlines, and pavement damaged. Hanging objects swung violently north-south. All crockery, china, bric-a-brac, pictures, etc., broken;

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everything upside down. Plaster cracked in several rooms. "My station building is No. A-3, one of six buildings plus two occupied mobile homes. Very heavy damage to all the buildings at the station. Many inspectors have been at the station but no final estimate made of the damage; however, it will probably exceed \$1 million." Ground: Compact, level.

Little Tujunga Road-Bear Canyon Area (Bear Divide Ranger Station, NW. 1/4, sec. 7, T. 3 N., R. 14 W., about 2.7 km. north-northeast of Pacoima Dam). Felt by and awakened all in community; frightened many (observer in new, large trailer home). Trailer bounced up and down. Very loud earth noises. Trees and bushes shook; vehicles rocked. Landslides. Rockslides on road up to 382,500 cu. m. Many cracks in fill ground and in solid ground. Block wall broken. Small objects shifted and broke; furniture shifted. Water sloshed from toilet bowls. "A giant up-and-down motion, changing to north-south side motion. Mobile home dead-manned from concrete to 1.27-cm. cable to 0.96-cm. eye-bolts--eyebolts straightened out." Ground: Fill over rock, compact soil, level to 40 percent grade.

#### Intensity VIII:

##### Granada Hills:

The following is from a report by Lew and others<sup>3</sup>: Van Gogh Street School: "Constructed in 1968. The school is in an area of ground rupture directly west of the Upper Van Norman Reservoir. The construction is a single-story wood frame and stucco. Although there was no collapse, there was major structural damage which consisted of buckling of slabs on grade, fracturing of concrete foundation walls, and displacement of bearing walls in the zone of cracked foundations. The lunch shelter columns were permanently bent approximately 15° at the base at the point of weakness created by openings for electrical outlet boxes. A cantilever concrete block garden wall leaned approximately 10° but remained standing. The underground utilities were severely damaged. The school has been repaired and is fully occupied." Patrick Henry Junior High School: "Constructed in 1959. The buildings are primarily one- and two-story reinforced grouted brick and concrete bearing wall structures. The major structural damage consisted of fracturing of four second-story columns of a two-story covered arcade. The concrete roof of the arcade was shored to prevent collapse. The longitudinal concrete wall in the classroom buildings, extending the full length of the buildings, sustained some hairline diagonal cracks near both ends of the building. The cracking can be attributed to shrinkage stresses that existed prior to the earthquake. A concrete curb at the corner of the mechanical pent-house fractured under the steel column at the brace connection. Structural damage was minimal; however, a major loss of lighting fixtures constituted a real hazard. There was nominal damage to acoustical ceiling tile. Electrical conduits were damaged. The damaged arcade has been removed. The entire school is in use." Structural damage at the Van Gogh Street School was reportedly caused by ground surface movement, and damage at the Patrick Henry Junior High School resulted from vibrational movement.

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17201 Courbet Street (about 1 km. west of Upper Van Norman Reservoir). Felt by, awakened, and frightened all in community (observer lying down in strongly built, one-story wood frame building). Motion slow, lasted about 2 minutes; direction east-west and up and down. Loud earth noises heard by many about 3 seconds before shock was felt. Hanging objects swung east-west. Pendulum clocks, facing south and east, stopped. Trees and bushes shaken strongly. Small objects and furnishings shifted; vases, etc., small objects, and furniture overturned. Plaster, windows, walls, chimneys, and ground cracked. Knick-knacks, books, pictures, and plaster fell. Dishes, windows, and furniture broke. Twisting and fall of chimneys, columns, and monuments. Damage great to masonry and concrete. Ground: Soil, compact, level.

16834 Bircher Street (southwest of Lower Van Norman Reservoir). Felt by and awakened all in community; frightened many (observer standing on second floor of 12-year-old, well-built, two-story wood frame building). Moderate earth noises heard by person outdoors. Trees and bushes shook; vehicles rocked. Block fences fell. Hanging objects swung violently northeast-southwest. Mantel pieces thrown and broken. China cabinet overturned. Minor plaster cracking. "Our tract (wood floors, lath, plaster, and stucco; one- and two-story homes) suffered minimal damage. However, newer dwellings to north and northwest (slab, wallboard construction) sustained major damage, many condemned. Holy Cross Hospital is about 4 km. east and the Van Gogh Street School is about 2 km. north of our home. Many commercial markets had major to minor damage; many business buildings marked 'unsafe.' Minor ground cracks north of our tract. Damage slight at my home." Ground: Compact, adobe fill; lot is level, tract is sloping.

10518 Encino Avenue. Felt by, awakened, and frightened all (observer walking in old, well-built, one-story stucco building). Loud earth noises. Ground cracks; landslides; water disturbed. Chimneys, tombstones, and elevated water tanks cracked, twisted, and overturned. Hanging objects swung violently. Small objects swung violently. Small objects shifted, overturned, and fell. Furniture shifted, overturned, and broke. Plaster cracked, broke, and fell. Damage slight. Ground: Compact, level.

17608 Blackhawk Street. (VII) Felt by, awakened, and frightened all in community (observer standing in new, well-built, one-story wood frame building). Faint, roaring earth noises preceded shock. Trees and bushes shook; vehicles rocked. Hanging objects swung violently east-west. Small objects overturned and fell; all cupboards on east-west walls emptied. "No observed fissures, faults, or landslides. Most 10.2-cm.-thick concrete block walls in neighborhood (running north-south) are down. East-west walls seem pretty good. Water tank, 113 l., shifted about 7.5 cm. S. 70° W. Several 0.32-cm.-thick cracks at attachment of garage to house and around bottom plate. No damage to our 10.2-cm.-thick block wall running north-south with #3 bars @ 81.3 cm. on center." Damage moderate. Ground: Compact, silty clay, slightly sloping to south.

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- 12038 Bambi Place. (VII) Felt by, awakened, and frightened all in community (observer sleeping in well-built, one-story wood frame building). Building rattled and vibrated. Ground cracked. Water and power off. Chimneys damaged in neighborhood. Small objects overturned and fell; glass and dishes broke. Bookcases moved about 15 to 20 cm. Damage slight.
- 12817 Neon Way. (VII) Felt by, awakened, and frightened all in community (observer sleeping in new, well-built, one-story wood frame building). Everything rattled. Building rocked back and forth. Loud earth noises. Trees and bushes shook; vehicles rocked. Ground cracked. Hanging objects swung violently north-south. Small objects overturned and fell. Furniture shifted, overturned, and broke. Cement and plaster cracked. "Everything affected." Damage slight to moderate. Ground: Compact, sloping; filled in.
- 16939 Colven Road. (VII) Felt by, awakened, and frightened all in community (observer sleeping in new, well-built, one-story wood frame building). "Tremendous displacement of building." Loud earth noises, like sonic boom. Chimney and concrete block wall cracked and knocked over. Hanging objects swung violently east-west. Small objects fell. Furniture overturned and broke. Plaster cracked and broke. Shower door cracked. Toilet bowl broke. Damage slight. Ground: Rocky, level.
- 16329 San Jose Street. (VII) Felt by, awakened, and frightened all in community (observer sleeping in 6-year-old, one-story wood frame building). Building creaked and banged loudly. Loud, rumbling or roaring earth noises. Chimneys overturned. About 0.6 m. of water slopped from swimming pool. Hanging objects swung violently east-west. Small objects fell. Floor lamps overturned. Plaster cracked. Damage slight. "There was quite a lot of vertical movement during the first part of the shock. It was almost impossible to walk for the first few seconds. I tried to walk and felt as if I were walking uphill." Damage slight. Ground: Compact, silty sand, level.
- 15832 Chatsworth Street. (VII) Felt by and awakened all in community (observer lying down on first floor of 50-year-old, well-built, two-story wood frame building). Earth noises sounded like a stampeding herd of horses. Trees and bushes shook; vehicles rocked. Foundation, driveway, and waterpipes cracked. Chimney broke at roofline. Two ceilings of tile fell. One light fixture and all pictures and mirrors down. Shelves and cupboards emptied. Bookcase and water cooler broke. "Outside damage was limited to west side. Our biggest bother was sorting and returning several thousand books to shelves. The shelves (fastened to the walls) were not damaged, just emptied. Later additions to the house were finished with wallboard--all seams cracked and must be redone. All plumbing in one bathroom broke." Damage slight. Ground: Compact, adobe.
- 10342 Odessa Avenue. (VII) Felt by, awakened, and frightened all in community (observer sleeping in 11-year-old, one-story wood frame building). Building made snapping sounds. Loud earth noises. Small objects fell; furniture shifted. Minor amount of plaster fell. Block wall collapsed. Minor driveway crack.

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Rock-facing in decorative chimney cracked. "Our home and community is located about 5 to 8 km. from the hardest hit areas of Sylmar and San Fernando. The house faces in a northwesterly direction, and during the shock it seemed to move north-south. Our driveway break (minor) also runs north-south. The block wall which collapsed in yard runs east-west. Our neighbor also commented about the north-south movement, although their home faces south and runs east-west. Based on the condition of the interior of house (fallen lamps, books, and dishes, etc.) it seemed that the front side (west) of house moved more than the back side. There was little displacement of objects on eastern side, but much on west side. Aftershocks also have seemed to move the house north-south, with only occasional east-west shocks. Although the aftershocks have decreased considerably in the three weeks since the main shock, I find the most disconcerting problem now is the continual popping sounds in walls and cabinets, sometimes very loud, and the creaking and springy feeling of the floors. I do believe so many homes in our area came through the earthquake so well because of the interior wallboard walls. Many of our friends who have lath and plaster did not come through the shock nearly so well." Ground: Claylike, compact, level.

9949 Ruffner Avenue. (VI) Felt by and awakened all in community; frightened few (observer sleeping in new, well-built, one-story wood frame building). Windows, doors, dishes, etc., rattled; building swayed. Generally moderate earth noises. "At first a mild shaking, then a severe jolt, lasting about 1 minute. Considerable amount of water splashed from swimming pool (15° angle) onto the patio. Minor cracks in patio. House suffered no severe damage. Ceiling beams were slightly twisted. Fish tank, 76 l., on stand did not fall, but about half of the water sloshed out. Considerable noise from ground rumble; wavelike formations in ground. Very fortunate." Ground: Compact, level.

11959 Salem Drive. (VI) Felt by, awakened, and frightened all in home (observer sitting in 11-year-old, well-built, one-story wood frame building). Windows, doors, and dishes rattled; building creaked. Hanging objects swung north-south. Small objects shifted and fell; furniture shifted; lamps fell. Cupboard doors opened. Plaster cracked. Electricity off. Damage slight. Ground: Compact, adobe; terraced hill.

10208 Monogram Avenue. (VI) Felt by and awakened all in community; frightened many (observer sleeping in old, well-built, one-story wood frame building). Windows, doors, and dishes rattled; building creaked. Trees and bushes shook; vehicles rocked. Hanging objects swung violently north-south and east-west. Small objects shifted, overturned, and fell; all dishes fell from cupboard. Furniture shifted. Plaster cracked slightly. "No structural damage." Ground: Clayey, compact, level.

17525 Los Alimos Street. (VI) Felt by all and frightened many in community; awakened and frightened all in 15-year-old, well-built, one-story wood frame building. Up-and-down pounding and twisting motion of building. Loud earth noises. Electricity and water off. Hanging objects swung violently from side to side. Small objects shifted, overturned, and fell; items thrown from cupboards.

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Heater overturned. Small plaster cracks. Ground: Clay, compact, level. 17163 Rinaldi Street. (VI) Felt by, awakened, and frightened all in community (observer standing in new, well-built, one-story wood frame building). Windows, doors, and dishes rattled; building creaked. Camper appeared to be shoved closer to truck cab. Small objects shifted, overturned, and fell. Damage slight. Ground: Compact, level.

No address given. (VI) Felt by all and frightened many in community; awakened all in old, well-built, one-story building. Windows, doors, dishes, etc., rattled. Loud earth noises. Furniture shifted, overturned, and broke. Windows cracked. Damage slight. (Report from Superintendent of Post Office.)

Mission Hills:

No address given. Felt by and awakened all in community; frightened many (observer walking in well-built, one-story stone building). Building twisted and shook. Trees and bushes shook; vehicles rocked. Ground cracks; landslides; disturbed water. Chimneys, tombstones, and elevated water tanks cracked and overturned. Hanging objects swung violently in various directions. Small objects shifted, overturned, and fell; furniture shifted, overturned, and broke. Plaster cracked, broke, and fell. Windows cracked. Damage great. Ground: Compact, level.

Mission San Fernando Rey (about 0.8 km. south of the Holy Cross Hospital). Adobe walls were severely cracked.

10222 Norwich Avenue. (VII) Felt by, awakened, and frightened practically all in community (observer sleeping in 10-year-old, well-built, one-story wood frame building; did not awaken 1-year-old child). Building very noisy. Loud earth noises. Trees and bushes shook; vehicles rocked. Hanging objects swung violently. Small objects shifted and overturned and broke. Heavy objects (15-kg. tape recorder, ashtrays, large outside planter) were thrown 0.9 to 1 m. and overturned. Six-year-old boy thrown out of bed. Light objects were not moved. "Noticed high-frequency, low-amplitude vertical motion at beginning of shock; low-frequency, high-amplitude lateral motion at end." No structural damage to building. Ground: Alluvium, compact, level.

15214 Tuba Street. (VI) Felt by and awakened all in community; frightened many (observer sleeping in well-built, one-story wood frame building). Windows, doors, dishes, etc., rattled; building creaked severely. Loud earth noises. Disturbed water. Hanging objects swung violently. Small objects fell. Damage slight. Ground: Compact, level.

Newhall-Valencia area:

Newhall:

The National Earthquake Information Center<sup>6</sup> reported: "Four old buildings in downtown Newhall were condemned by the City Engineer, who also estimated 90 percent of the fireplaces and chimneys on two-story houses were damaged in the area. One concrete wall was knocked down; most homes sustained only superficial damage." Gasline broke on Lyons Avenue. Newhall phone plant was flooded by a broken water main. The California Institute of Technology<sup>2</sup>

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reported that a glass manufacturing company (between Newhall and Saugus) sustained \$10 million damage to buildings, storage bins, and furnaces. There was damage to oil refinery storage tanks and pipelines at the Newhall refinery located about 3.2 km. southeast of Newhall<sup>1</sup>. The bottom of one jet-fuel storage tank buckled, and there were scattered leaks elsewhere in the plant. The chief problem for the refinery was lack of water. Both sides of a booster pump on the waterline leading to the refinery were ruptured. Minor damage was done to testing equipment in the laboratory.

18909 Sierra Estates Drive (about 8 km. northeast of Newhall post office). Felt by, awakened, and frightened all in community (observer sitting on second level of new, tri-level wood frame building). Vehicles rocked. Water supply cut off. Some chimneys loosened from homes; walls, concrete slabs, etc., cracked. Many store windows broke. China closet overturned. Damage great. Ground: Compact, sloping. (This observer gives "place" as Newhall, Soledad, and entire area.)

26861 B Avenue of the Oaks (about 8 km. northeast of Newhall post office). Felt by, awakened, and frightened all in community; general panic (observer sleeping in new, one-story wood frame building). Vehicles shifted. Ground cracks; disturbed water. Side walls lifted and shifted; retaining walls tilted. Drywalls had few cracks. Hanging objects swung violently southeast-northwest. Small objects shifted, overturned, and fell. Furniture shifted and overturned. "Shock was like a dropping motion, then a shift from northeast-southwest. Large TV thrown off stand. Bookshelves and books on floor; lamps thrown to floor; kitchen cupboards emptied of all contents, canned goods, dishes, etc. Refrigerator doors thrown open and contents slid out onto floor. Large dresser (on short legs) full of material, shifted about 23 cm. on carpeted floor. Had to leave premises due to my wife being disturbed." Damage moderate. Ground: Compact fill, level.

24522 Walnut Street. Frightened all in home and community (observer lying down in old, poorly built, wood frame building). House creaked very strongly. Loud earth noises. Trees and bushes shook; vehicles rocked. Hanging objects swung violently in every direction. Furniture shifted, overturned, and broke. Ground cracks; landslides; disturbed water nearby. Chimneys, tombstones, and elevated water tanks cracked, twisted, and overturned. Plaster cracked. Moderate damage to house. Ground: Compact, level.

24736 Walnut Street. (VII) "We were not at home during the earthquake, but when we returned home we found beds, heavy bookcases, the stoves, dressers, etc., had all shifted. The house is an old, wood frame building. One bookcase was overturned. Top of chimney, to about 1.2 m. below the roofline, broke off and fell, and made a dent in the lawn about 0.3 m. deep. All rooms except the kitchen have cracks in walls. Outside concrete slab is cracked. No broken windows."

Newhall Ranger Station (about 1-1/2 km. south of Newhall). (VII) Felt by, awakened, and frightened all in community (observer lying down in old, well-built, one-



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story wood frame building). House rocked and heaved, and made crashing, splintering, and breaking sounds. Loud, explosivelike earth noises a split second before shock. Trees and bushes shook. Ground cracked. Pipelines broke. Chimneys cracked and bricks "rearranged." Hanging objects swung violently south. Small objects shifted, overturned, and fell. Furniture shifted. Plaster cracked. Windows separated from casement but glass did not break. "This site is a 1-acre housing compound of the U.S. Forest Service administrative buildings. The structures, two offices, one 6-bay garage, one barracks, several small outbuildings, and one residence, were constructed in 1934, and are of wood; very well built. All doors and cabinets in the residence and offices were thrown open and contents spilled to the floor. Direction of thrust appeared to be to the south. No furniture of any appreciable size was knocked over, but very heavy pieces were shifted several cm. Electricity, phone, and water services were knocked out at impact. Cracks in plaster and paneling of not much significance. Hairline cracks are apparent in and on all of the buildings, but appear to be the result of aftershocks." Damage slight. Ground: Compact, level.

- 23405 La Glorita Circle. (VII) Felt by all and awakened many in community; frightened many in new, two-story wood frame building (observer sleeping). Loud, rumbling earth noises. Patio block walls loosened. Lamps and books fell. Piano and refrigerator moved. Plaster cracked slightly over windows and doors. "Market 2 blocks away lost windows." Damage slight. Ground: Level.
- 22739 W. 8th Street. (VII) Felt by, awakened, and frightened all (observer standing in 8-year-old, well-built, two-story wood frame building). Building moved violently. Loud earth noises. Hanging objects swung north-south. Small objects overturned and fell. Furniture shifted and overturned. Plaster and windows cracked. Damage slight. "The apartment swayed violently, throwing me from side to side. Everything came out of cupboards and refrigerator. Lights went out. Terrifying experience. Had head wound from some unknown object." Ground: Level.
- 23157 Market Street. (VI) Felt by all in community; awakened all in new, well-built, one-story wood frame building; frightened few children. Windows, doors, dishes, etc., rattled; building rumbled. Faint earth noises at first, then grew louder. Driveway cracked. Small objects shifted. Ground: Compact, sloping.
- 24200 Lyons Avenue, Valencia; building in Valencia Shopping Center. (VII) The USGS-NOAA report<sup>9</sup> stated: "The building is a one-story brick masonry and wood roof construction. Masonry walls appear to be continuous on three sides of the building, but are reduced to relatively short walls on each side of the large glassed opening at the front. A large sign projects above the roof at one end of one of the short walls. Large sections of the suspended ceiling collapsed; almost all the glass in the front wall broke. The brick walls at the front spalled at ceiling level, and additional spalling occurred near ceiling level at the sign support."
- 25310 Via Calinda, Valencia. (VII) Felt by, awakened, and frightened all in

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community (observer sleeping in new, well-built, one-story wood frame building). Roaring earth noises. Water disturbed. Chimneys cracked, twisted, and overturned. Hanging objects swung violently; chandelier fell. Small objects shifted, overturned, and fell; mirrors fell from walls; dishes fell out of cupboards. TV overturned. Small amount of plaster cracked, broke, and fell. Windows cracked in nearby houses. "In the city of Newhall block walls were knocked over." Damage moderate. Ground: Compacted fill over level ground.

25349 N. Avenue Ronanda, Valencia. (VII) Felt by and frightened all in community; awakened all in new, well-built, one-story wood frame building. Building creaked considerably. Loud earth noises. Chimneys cracked, twisted, and overturned. Garden walls down. Hanging objects swung violently northeast-southwest. Small objects overturned and fell; many dishes broke. Furniture shifted and overturned. "Sensation of violent rotary motion." Ground: Compact.

25657 Avenida Jolita, Valencia. (VII) Felt by, awakened, and frightened all in community (observer standing on second floor of new, well-built, two-story wood frame building). Windows, doors, and dishes rattled. "Could not hear earth noises because of falling objects." Chimney separated from house. Hanging objects swung moderately east-west. Small objects shifted, overturned, and fell; many items fell. Furniture shifted, overturned, and broke. Some plaster cracking. Damage slight. Ground: Compact, level; former farmland.

23919 Via Onda, Valencia. (VII) Felt by, awakened, and frightened all (observer sleeping on second floor of new, two-story wood frame building). Building creaked loudly. Loud earth noises. Chimneys cracked. Block wall fell. Slabs cracked. Hanging objects swung violently. Small objects fell. Furniture shifted and overturned. Plaster cracked. Damage slight. Ground: Gravelly, sloping.

Saugus, Honby, and Soledad Canyon areas east of Saugus:

Saugus. Felt by all in community; awakened and frightened many. Trees and bushes shook; vehicles rocked. Ground cracked. Trailer foundations cracked. Hanging objects swung violently. Most light fixtures fell. Small objects shifted, overturned, and fell. Furniture shifted, overturned, and broke. Plaster cracked, broke, and fell. Windows broke. "There were eight people working in the post office at the time. Everyone got out just in time to avoid falling light fixtures. Equipment was tossed around more in our trailer complex (seven aluminum trailers placed together) than it was in our main office (wood and brick building). The crew maintained their composure, as far as I could see, but it was the general consensus that if the shock had lasted much longer, panic would have resulted." Ground: Sloping and level.

Honby area (about 6 km. east by north of Saugus):

North Oaks Shopping Center and Honby School. The USGS-NOAA report<sup>9</sup> noted the following: "Department store, 19419 Soledad Canyon Road: The building is one story with brick exterior walls, glued-laminated beams, and panelized wood roof. The rear wall of the building separated from the roof by about 9 inches in one area, and the adjacent roof section collapsed. Other sections of roof along the side walls also collapsed, and purlins were pulled out of their supports.

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**Building material store (19407 Soledad Canyon Road):** The building is one story with brick exterior walls, interior columns, and wood roof construction. Brick piers spalled at connection to wood beams along front wall. Interior partitions cracked. Several main beams were pulled out from the masonry at their support along the front wall. Ledgers along masonry walls were pulled out, and parts of the roof structure collapsed. Cracks occurred in the paving of a nearby parking lot . . . " The report also stated that at the Honby School, ground surface cracking occurred throughout the site. One crack passed through one of the school buildings.

**27327 Camp Plenty Road, Honby (just north of Soledad Canyon Road).** Felt by, awakened, and frightened all in community (observer sleeping in old, well-built, one-story wood frame building). Loud earth noises, like multiple sonic booms. Six-hundred-pound transmitter overturned to south. Bookcase overturned and others moved. Plaster cracked. "All plasterboard joints show cracks. Some vertical cracks in foundation. No ground cracks here, but shopping centers close by (about 274 m.) have cracks in blacktop parking lots. Roof collapsed on north side of W. T. Grant Building. Fifty to 70 percent of store windows broke. Highway bridges need repairs to approaches. Aftershocks for first 2 days were sharp, like sonic booms; later aftershocks were quiet shakes preceded by rumble." Damage slight. Ground: Adjacent to Santa Clara River bed, level.

**27430 Fairport Avenue, Honby.** Felt by, awakened, and frightened all in community; general panic (observer sleeping on second floor of new, well-built, two-story wood frame building). Loud, rumbling earth noises. Ground cracked; disturbed water. Chimney cracked; top pulled about 10 cm. away from house. Block walls fell; others were loosened (walls running east-west). Hanging objects swung violently. Electricity off. Small objects overturned and fell; dishes and vases crashed. Furniture shifted. Plaster cracked, broke, and fell. One window broke. Sliding closet doors (tops only) came out of grooves. Shelves were emptied. "All persons I have spoken with said it felt as if their building would topple. We have about a 4.8-m. trailer parked in driveway and it twisted or jumped over 0.3 m. In the community, streets cracked, curbs broken, and many buildings were condemned. I teach at the Honby School (one-story building; six classrooms). Over 2.5-cm.-wide floor crack across center of slab; section dropped about 4 cm.; some doors will not open and some will not close; new blacktop cracked and broken. Many people have asked for transfers for their children and are leaving the community. At my home (front faces west), a front door latch (locked) broke off; the door was opened but held by safety catch. Same thing happened at neighbor's house. Damage moderate to house." Ground: Sandy, level, gently sloping to street.

**27416 Dewdrop, Honby.** Felt by, awakened, and frightened all in community (observer sitting in well-built, one-story wood frame building). Loud earth noises. Ground cracked. Chimneys, tombstones, and elevated water tanks cracked, twisted, and overturned. Hanging objects swung violently. Small

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objects fell. Furniture shifted, overturned, and broke. Plaster cracks in swimming pool. Damage moderate. Ground: Level.

28189 Hot Springs Avenue (north Honby area south of Plum Canyon). (VII) Felt by, awakened, and frightened all in community (observer sitting in 7-year-old, fairly well-built, one-story wood frame building). Building bounced in all directions. Locked doors swung open, then closed. Could not hear earth noises because of house noise and the noise of breaking objects. Vehicles rocked. About 0.6-cm.-wide ground cracks. Block walls flattened. Chimneys cracked and twisted. Hanging objects swung violently in all directions. Small objects overturned and fell. Stucco cracked. Damage slight to building. Ground: Rocky, gravelly, mixed with clay, level (mesa).

10511 Soledad Canyon Road, near Soledad (about 11 km. east by north of Honby). Felt by, awakened, and frightened all in community (observers walking and sleeping in old, well-built, one-story wood frame building). Building swayed. Loud earth noises. Trees and bushes shook; vehicles rocked. Ground cracked; landslides; disturbed water. Chimneys cracked, twisted, and overturned. Roof split. Dishes and miscellaneous articles scattered and broke. Water heater tore loose. Hanging objects swung violently east-west. Furniture shifted, overturned, and broke. Damage slight to house. Ground: Sandy, decomposed granite, loose, compact, level.

Solemint and southeast of, in Iron Canyon. The USGS-NOAA report<sup>9</sup> noted that at Solemint (east of Honby), the Soledad Canyon School was damaged by ground surface movement. Diagonal cracking was observed throughout the school site. The press reported that southeast of Solemint, in Iron Canyon, a house and land "slipped" more than 9 m. and that Head Road in Iron Canyon "dropped" 4.5 m.

#### Intensity VII:

##### Alhambra:

The following, from Steinbrugge and others<sup>8</sup>, does not include publicly owned structures: "Fifty-five buildings damaged; 15 posted unsafe; 5 commercial buildings demolished or to be demolished; 400 chimneys damaged; estimated total dollar loss, \$2 million." Other observers stated: "Damage was light, except to old buildings in business district where some (very few) plate glass windows were broken; one old brick building lost parapet walls and front."

"Damage was slight in the Alhambra area. In wood frame buildings, damage was limited to cracked plaster and windows, broken dishes and knickknacks. Store buildings suffered broken plate glass windows. Chimneys pulled away from some buildings. Several unreinforced brick parapets fell." Press reported powerlines were down. "My office (2 N. El Molino) is in a one-story brick building with large plate glass windows; no damage to windows or building. Two blocks west, one plate glass window was lost in a full block of large plate glass windows."

823 S. Almansor Street. (VI) Felt by and awakened all in community; frightened many (observer walking in new, one-story wood frame building). "Started

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with a high-frequency vibration that set dishes rattling; then the ground motion, not too sharp or of high acceleration but appeared to have a sizable amplitude." Pendulum clock, pendulum swinging east-west, did not stop. Small objects shifted. Water in toilet tank sloshed out north-south. Ground: Compact.

718 N. Monterey Street. (VI) Felt by all and frightened many in community; awakened all in new, three-story wood frame building (observer in shower). Doors and drawers opened; some dishes fell out. Trees and bushes shook; vehicles rocked. Hanging objects swung moderately north-south. "Damage slight in neighborhood. Earthquake appeared to have long duration, about 10 to 15 minutes, due to the aftershocks. Noticeable up-and-down motion." Ground: Compact, level.

112 E. Alhambra Road. (VI) Felt by and awakened all in community; frightened many (observer lying down on third floor of new, three-story wood frame building). Building made loud racking sound. Moderate earth noises. Trees and bushes shook; vehicles rocked. Swimming pool lost 31 to 46 cm. of water. Hanging objects swung moderately east-west. Small objects shifted, overturned, and fell; furniture shifted. Plaster cracked; windows broke. Damage slight. Ground: Gravelly, compact, level.

801 Geranio Drive. (VI) Felt by all in community; awakened and frightened all in old, well-built, one-story wood frame building (observer standing). Loud earth noises. Small objects shifted. Slight plaster and stucco cracks. "First noticed fairly loud noise, similar to a very noisy truck; then the house started to shiver, then shake. Direction of motion not noted. Shaking seemed to last an eternity." Ground: Compact, sloping.

1605 S. Garfield Avenue. (VI) Felt by, awakened, and frightened all in community (observer lying down in old, well-built, one-story wood frame building). Building creaked moderately. Loud earth noises. Chimneys cracked. Hanging objects swung violently east-west. Small objects shifted, overturned, and fell. Few hairline cracks. Ground: Compact, level.

777 E. Valley Boulevard. (VI) Felt by and awakened all in community; frightened many (observer sleeping in new, well-built, one-story wood and concrete block building). Extensive rattling of windows, doors, dishes, etc.; building creaked throughout tremor. Moderate earth noises, similar to heavy wind, preceded shock. Trees and bushes shook. Electrical transformer explosions; power out for almost 1 hour. Small objects shifted west-east; furniture shifted. Only minor plaster cracks. Ground: Clay loam, compact, level.

2412 Capetown Avenue. (VI) Felt by, awakened, and frightened all (observer standing in well-built, one-story wood frame building). Building creaked rather violently. Electrical flashes noted outside; light went out momentarily. Hanging objects swung violently. Loose objects fell to floor. Few minor plaster cracks. "This area in which I live consists of several hundred well-constructed wood frame homes built in the mid-50's. This was by far the strongest shock felt during my 17 years at this location. From my observations since the earthquake, there appears to be no damage to homes or streets in this immediate

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area. I understand that the buildings in the business district of Alhambra did sustain varying degrees of damage." Ground: Compact clay, sloping; small hills.

820 N. Hidalgo Avenue. (VI) Felt by all in community; awakened all and frightened few in old, well-built, one-story wood frame building. "Too much dish rattling to hear any creaking of house or earth noises." Hanging objects swung strongly east-west. Small objects shifted. Plaster cracked near some door frames. "No noticeable outside effects." Ground: Clayey, level.

Altadena:

1701 Coolidge Avenue. Felt by and awakened all; frightened few (observer lying down in well-built, one-story wood frame building). Motion rapid; direction east-west. Loud earth noises. Chimneys fell. Small objects and furnishings shifted; small objects and furniture overturned. Plaster, windows, walls, chimneys, and ground cracked. Knickknacks, books, pictures, and plaster fell. Damage slight (?). Ground: Soil, level. Press reported powerlines down.

2624-G N. Lake Avenue. Felt by and awakened all in well-built, one-story wood frame and concrete slab apartment building over concrete garages (observer sitting; couldn't get up). "Almost solid aftershocks for half an hour. Couldn't distinguish other noises due to general falling and crashing of objects. Power failure in a few minutes was worse than the aftershocks. Everything tall fell. Left for work at 6:58 a.m. No evidence of shock as I drove south on Lake Avenue. However, in the Board of Education Building (in Pasadena), library shelves had fallen west from against east wall. Books from shelves were also tossed every which way. Things in hall cupboards fell. General problem. Big window at Bullocks, Pasadena, shattered. Aftershocks came with regularity every few minutes after the initial bump which definitely preceded the sway in Altadena. I would say we had between 10 and 20 small aftershocks--sometimes no more than a queasy vertigo--after the initial shock. At least four were of fair violence."

510 E. Calaveras Street. (VI) Felt by and awakened all in community; frightened many; all in well-built, one story concrete block building with concrete slab floors. "All motion seemed rapid, jerky, horizontal; no vertical acceleration felt." Block creaked; roof groaned. Trees shook. Chimneys cracked and twisted. Hanging objects swung violently east-west. Small objects fell. About one-tenth of water in fish tank splashed out. Plaster cracked. Damage slight. Ground: Gravelly loam, alluvial fan; 6-percent grade.

988 Mount Curve Avenue. (VI) Felt by and awakened all in community; frightened many (observer lying down on second floor of two-story wood frame building). Loud earth noises from west heard by few 3 seconds before shock. Hanging objects swung east-west. Pendulum clock facing north stopped. Trees and bushes shook moderately. Small objects and furniture shifted; vases and small objects overturned. Plaster, walls, and chimneys cracked. Knickknacks, books, pictures, dishes, and plaster fell. Damage slight. Rapid motion from west, lasting 1 minute. Ground: Rocky soil, loose, sloping.

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3104 Mount Curve Avenue. (VI) Old, poorly built, two-story wood frame building.

"Wife and I were awakened but children were not; wife was frightened; I was alarmed." Windows, doors, and dishes rattled severely; building creaked severely. Books and dishes thrown from shelves. Two bad plaster cracks; brick wall cracked. Damage slight. Ground: Gravelly, loam, sloping.

Post Office. (VI) Felt by and frightened all in well-built, one-story stucco building. Entire building swayed and shook. Loud earth noises. Trees and bushes shook; vehicles rocked. Flashes in sky due to shorting transformers. Hanging lights swung violently. Mail fell from cases. Plaster cracked, broke, and fell. Ground: Compact, sloping.

1601 Crest Drive. (VI) Felt by and awakened all in community; frightened all in 14-year-old, one-story wood frame building (observer lying down). Building creaked severely. Faint earth noises. Water splashed from swimming pool. Chimney cracked slightly; powder and chips around fireplace. Hanging objects swung moderately. Doors opened on north-south cupboards. Loose headboard on bed overturned north-south. Ground: Decomposed granite.

154 E. Wapello Street. (VI) Felt by and awakened all in old, well-built, one-story wood frame building; frightened few. Moderate earth noises. Hanging objects along all walls swung moderately. Small objects shifted, overturned, and fell. Furniture in garage overturned and broke. Top of fireplace cracked. Ground: Compact, sloping.

12104 N. Craig Avenue. (VI) Felt by and awakened all in community; frightened many (observer walking on second floor of old, well-built, two-story wood frame building). Some racking sounds of building. Loud, rumbling earth noises. Hanging objects swung violently in mostly north-south direction. Small objects overturned and fell. TV fell off shelf. Plaster cracked and broke. Top of chimney collapsed. Damage slight. Ground: Gravelly, compact, level.

925 Concha Street. (VI) Felt by and frightened all in community; frightened all in old, well-built, one-story wood frame building. Building creaked very loudly. Loud earth noises. Small objects shifted, overturned, and fell. Water in swimming pool splashed violently north-south. Books dumped from shelves; dishes knocked from cupboards. "All aftershocks were plainly felt; slight water action observed on surface of pool. House is about 3 m. above street, with steep driveway to garage under house." Ground: Sloping, filled in.

1065 Concha Street. (VI) Felt by, awakened, and frightened all in community (observer sleeping in old, one-story wood frame building). Windows, doors, dishes, etc., rattled very severely. Loud earth noises. Trees and bushes shook; vehicles rocked. Water disturbed. Hanging objects swung moderately northwest-southeast. Small objects overturned. Plaster cracked, broke, and fell (minor). "One piano in neighborhood escaped caster cups. Substantial amount of broken china and kitchenware. Aftershocks easily felt, but of much less intensity." Ground: Compact, sloping.

3078 Raymond Avenue. (VI) Felt by, awakened, and frightened all in well-built, one-story wood frame building (built in 1940). Noisy and twisting west-east motion.

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Pods fell from carob tree. Hanging objects swung moderately northwest-southeast. Small objects shifted. Ironing board overturned. Plaster cracked very slightly. Ground: Decomposed granite, compact, sloping.

254 W. Harriet Street. (VI) Felt by, awakened, and frightened all in community (observer lying down in strongly built, one-story wood frame building). Rapid up-and-down motion. Loud earth noises, 4 to 5 seconds before shock, seemed to come from all directions. Hanging objects swung northeast. Trees and bushes shook moderately. Small objects and furnishings shifted; furniture shifted slightly. Two plates on wall broke. "Knickknacks and books fell from shelves on north-northeast walls, some traveled across room; nothing fell from east-west walls." Ground: Rocky, sandy sediment on alluvial fan.

3083 N. Olive Avenue. (VI) Felt by all in community; awakened and frightened all in strongly built wood frame building (observer lying down). Rapid northwest motion. Moderate earth noises, 1 second before shock, seemed from all directions. Hanging objects swung. Trees and bushes shook moderately. Small objects and furnishings shifted; vases, etc., overturned; knickknacks fell. Ground cracked. Chimney twisted. Ground: Level.

1234 Sonoma Drive. (VI) Felt by and awakened all in community; frightened many (observer sleeping in well-built, 22-year-old, one-story wood frame building). Building creaked rather strongly. Trees and bushes shook; vehicles rocked. Small objects shifted, overturned, and fell. "No damage to our chimney, but others were not so lucky." Ground: Principally clay and decomposed granite; very little top soil.

2087 N. Grand Oaks Avenue. (VI) Felt by, awakened, and frightened all in community (observer sleeping in well-built, 31-year-old, one-story wood frame building). Windows rattled. Moderate earth noises. Trees and bushes shook. Hanging objects swung moderately north-south. Small objects shifted. Ground: Rocky, level.

1920 Midwick Drive. (VI) Felt by all in community; awakened and frightened all in new, well-built, one-story wood frame building (observer sleeping). Dishes rattled violently; walls made straining sound. Hanging objects swung east-west. Lamps overturned; glasses thrown from desk. Plaster chips fell on mantel. Small cracks in brick. "It was a violent motion. Lights with mercury switches flashed on and off. Books shifted to front edges of bookshelves." Ground: Gravelly, level, slightly sloping.

No address given. (VI) Felt by and awakened all in well-built, one-story wood frame building (observer sleeping). Building creaked. Loud earth noises. Dogs howled. Water in swimming pool, about 15 cm. below deck, splashed out. Small objects shifted, overturned, and fell.

#### Beverly Hills:

The following, from Steinbrugge and others<sup>8</sup>, does not include publicly owned structures: "135 buildings damaged; 2 commercial buildings demolished or to be demolished; 1,000 chimneys damaged; estimated total dollar loss, \$800,000."



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8500 Wilshire Boulevard. (VI) "The greatest damage at my father's office (10-story building plus two-floor garage) was that all shelves mounted on one west-facing wall were thrown to the floor (shelf standards ripped off)."

709 N. Alta Drive. (VI) Felt by, awakened, and frightened all in community (observer sleeping on first floor of old, well-built, two-story wood frame building). Trees and bushes shook; vehicles rocked. Hanging objects swung moderately north-south. Small objects shifted, overturned, and fell. Windows cracked in some commercial buildings. "Motion seemed predominantly north-south. When inspecting buildings near the epicenter, owners said that aftershocks were very closely spaced for a long time after the main shock." Ground: Compact, sloping.

9545 Tullis Drive. (VI) Felt by all in community; awakened and frightened many (observer sleeping in well-built, one-story wood frame building). Couldn't hear house noises due to earth rumble. Water sloshed from many swimming pools in the area. Books fell from both north-south and east-west walls. Bookshelf fell. One bowl broke; one lamp broke. One loosened and cracked hearth brick. "Continuing aftershocks." Ground: Sloping.

8725 Clifton Way. (VI) Felt by and awakened all in community; frightened few (observer sleeping on first floor of new, three-story wood frame building). Loud earth noises. Hanging objects swung moderately north-south. Small objects and some glassware fell. Furniture shifted very slightly. Some plaster cracks. Damage very slight. "Saw one chimney failure; some store windows cracked." Ground: Adobe, level.

2267 Betty Lane. (VI) Felt by, awakened, and frightened all in community (observer in fairly new, well-built, one-story wood frame building). Building creaked. Hanging objects swung violently. Small objects shifted and fell; bottles fell off shelf; some dishes shifted enough to cause breakage. Power off. Ground: Bedrock; Santa Monica Mountains.

#### Burbank:

The following, from Steinbrugge and others<sup>8</sup>, does not include publicly owned structures: "445 buildings damaged; 25 posted unsafe; demolished or to be demolished--residential, 3; commercial, 3; churches and schools, 1; 500 chimneys damaged; estimated total dollar loss, \$4 million."

209 N. Naomi Street. Felt by and awakened all in community; frightened many; general excitement. A number of persons left their houses during the shock; people walked unsteadily. Observer's house (built in 1947) is a well-built, one-story wood frame building with later additions. Other houses in the neighborhood are mostly one-story wood frame dwellings with exterior stucco (built about 1947). "This neighborhood is located in southwestern Burbank. Motion in this area was an increasingly rapid, complex shaking for roughly 10 to 15 seconds after being awakened. After the motion had reached a peak, it began slowly to decrease in intensity; however, ground motion did not stop completely until after a considerable length of time; there was a short interval before the next shock. Two roars (very prominently heard in this neighborhood) were emitted from a

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powerplant about 3 km. from here as the quake caused valves to close as steam shot out. Power was knocked out in this neighborhood and remained out for slightly more than 2 hours. Many plate glass windows at nearby business establishments were broken. A substantial number (about 10 percent) of chimneys in this neighborhood were cracked, several so severely that their upper portions had to be removed. A few chimneys were slightly separated from houses, and the upper portions of a few were very slightly twisted. One straight crack, clearly visible from the street, extended from the base to the roof of a single-story library about 0.4 km. to the north, and several long, conspicuous cracks formed in plaster interior walls of a church about 0.8 km. north of here. Damage in other parts of Burbank: Instances of cracked walls, badly cracked chimneys, shattered windows, and other damage were common in much of Burbank. Some old buildings had extensively damaged walls and ceilings and were considered unsafe. Some of the severe damage included the fall of portions of the exterior walls just below the roofs of a church and a rest home, both relatively old buildings near downtown Burbank, and walls of both predominantly of brick. Although the worst damage was typically to older buildings, minor damage was common in newer ones. In spite of much costly damage in places, at many other places damage was virtually nil. Brilliant, quick flashes of light were seen in various directions (apparently related to effect on powerlines or transformers). In my house a number of things fell from shelves or tables, or were tipped over, or changed positions (as happened, undoubtedly, at all houses near here). A few knickknacks in precarious positions seemed surprisingly virtually unaffected; however, a water softener tank, just outside the house, jiggled off one of its three supports and tilted. The tank is too heavy for one person to move without great difficulty. Nothing in my house was broken. Glassware broke at next-door neighbor's house. Probably some things were broken at nearly every house around here. (Incidentally, relatives living in eastern foothills of Burbank reported figurines in glass dome were turned around even though the dome itself was unaffected. No windows were damaged at our house and none were damaged at most of the neighbors' houses. Our house had no obvious damage. The walls of our next-door neighbor's house developed some narrow cracks in various places. Narrow cracks developed in walls, especially at corners of windows and doors, in many buildings in this neighborhood. Small chips of plaster fell in several buildings. Some garden walls were cracked, several were significantly weakened." This observer reported that more than 120 aftershocks had been felt up to June 21. Ground: Compact alluvial soil, level.

702 N. Bel Aire Drive. Felt by all and frightened many in community; awakened all in old, well-built, one-story wood frame building. Loud earth noises. Chimneys cracked, twisted, and overturned. Hanging objects swung violently. Small objects overturned and fell. Plaster cracked, broke, and fell. Windows cracked. "Damage great to unreinforced brick." Ground: Gravelly, rocky, sloping.

Post Office. (VI) Felt by and frightened many in community (observer active in new, one-story precast concrete building). Ceiling fell--strings of lights. Loud earth

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noises. Vehicles rocked. Electricity disturbed. Hanging objects swung violently. Small objects shifted, overturned, and fell. Furniture shifted. One plate glass window, 3.6 by 3.6 m., broke. Damage moderate. Ground: Compact, level.

- 919 University Avenue. (VI) Felt by and awakened all in community; frightened all in 20-year-old, well-built, two-story wood frame building (observer lying down). All cupboard doors opened. Loud, rumbling earth noises. Water splashed from swimming pools. Chimneys on neighbors' houses cracked and twisted. Flashes from powerlines. Hanging objects swung violently in generally east-west direction. Doors banged. Books, vases, groceries, etc., fell. Lamps overturned. Furniture shifted. Plaster cracked at some doors and windows. No structural damage. Ground: Terraced pads at foot of Verdugo Mountains, compact.
- 611 Santa Anita Avenue. (VI) Felt by and awakened all in community; frightened many (observer sleeping on second floor of 12-year-old, well-built, two-story wood frame building). Moderate earth noises with high-pitched sound. Electricity and phones out. Hanging objects swung moderately. Small objects shifted, overturned, and fell. Furniture shifted and overturned. Plaster cracked. "The earthquake once it was over didn't seem so bad. We were alive and had suffered very little damage in comparison to others. The most frightening part was the aftershocks--not knowing when they would come or how strong they would be. We lived in continual fear for the next few days." Ground: Compact, sloping.
- 1014 N. Florence Avenue. (VI) Felt by, awakened, and frightened all in community; general panic (observer sleeping in old, one-story wood frame building). Heavy items moved from walls. Earth noises. Water disturbed. Hanging objects swung violently. Small objects shifted, overturned, and fell. Plaster cracked. Damage slight. Ground: Alluvium, level.
- 733 S. Mariposa Street. (VI) Felt by, awakened, and frightened all in old, well-built, two-story building. Loud earth noises. Hanging objects swung. Small objects shifted, overturned, and fell. Plaster cracked and fell.
- 1411 Chandler Boulevard. (VI) Felt by, awakened, and frightened all in community (observer sleeping in old, well-built, wood frame building). Building rocked. Water emptied from birdbath. Small objects shifted, overturned, and fell. Slight plaster crack. Ground: Compact, level.
- 524 E. Santa Anita Avenue. (VI) Felt by, awakened, and frightened all in community (observer sleeping on first floor of new, well-built, two-story wood frame building). Loud, rumbling earth noises. Vehicles rocked. Water disturbed. Small objects shifted, overturned, and fell. Plaster fell. Ground: Sloping.
- 807 E. Andover Drive. (VI) Felt by and awakened all in well-built wood frame building; frightened few. Wood joints moved. Hanging objects swung moderately east-west. Moderate earth noises. Glasses knocked out of cupboards; vases and books fell. Furniture shifted. "I have checked approximately 12 houses in my area and found no structural damage. Only items of interest were the movement of furniture, items falling out of cabinets, off tables, dressers, etc., and broken windows. Damage slight." Ground: Gravelly, compact, sloping.