

An Official Report on the San Fernando Earthquake

Just two days after the February 9, 1971, San Fernando earthquake, the Los Angeles County Board of Supervisors appointed a commission—under the chairmanship of Harold Brown—“to examine what happened during the earthquake, to assemble facts, to draw conclusions and make recommendations as to what actions could and should be taken in advance of future earthquakes to minimize casualties, physical effects and the disruptions of the orderly functions of society.” The findings of the Los Angeles County Earthquake Commission, now presented in a 45-page report, represent

more than 20 meetings of the commissioners, many individual and group tours of the damaged areas, the reading and discussion of more than 50 reports, and testimony from 36 earthquake and engineering experts.

Without claiming to be the definitive scientific account of the February 9 quake, the report analyzes what took place, and makes urgent recommendations for actions to reduce the hazards to life, property, and essential services in future—and inevitable—earthquakes in southern California.

The most dramatic of the report's

conclusions and recommendations is that 20,000 to 40,000 pre-1933 buildings in the greater Los Angeles area should be demolished or rehabilitated. The probability of thousands of these substandard buildings collapsing during a strong earthquake constitutes a serious threat to public safety, and the cost estimates for replacing them exceed a billion dollars. But the commission believes that a phased, well-organized program—encouraged by appropriate tax relief and other incentives—should be undertaken and that full compliance with its recommendations by 1980 is an achievable goal.

In addition to 15 specific recommendations and conclusions (page 21), the report includes sections that discuss earthquakes as a general southern California problem, emergency operations for earthquakes, their effects on the works of man, hazardous old buildings, land usage, earthquake insurance, and statistical summaries of casualties and damages in the February 9 earthquake.

Joining Brown on the seven-member citizen panel were Arthur E. Mann, senior vice president of Daniel, Mann, Johnson and Mendenhall; William A. Simpson Jr., chairman of the board of William Simpson Construction Company; John Grindle, president of American National Realty Company; George W. Housner, professor of civil engineering and applied mechanics at Caltech and president of the International Association of Earthquake Engineering; Clarkson W. Pinkham, president of the Structural Engineers Association of Southern California; and Charles F. Richter, professor of seismology, emeritus, at Caltech.

Clarence R. Allen, professor of geology and geophysics; Donald E. Hudson, professor of mechanical engineering and applied mechanics; and Hardy C. Martel, associate professor of electrical engineering and executive assistant to President Brown, served as alternate members from Caltech. Lee A. DuBridge, president emeritus, was a consultant to the commission.



Modern residences of “non-typical” design and construction suffered heavy damage in the San Fernando earthquake. These split-level homes near Sylmar did not survive the strong ground shaking.

The Los Angeles County Earthquake Commission: Conclusions and Recommendations

1. Hazardous Old Buildings. Thousands of pre-1933 buildings in Southern California constitute the most serious threat to public safety because of the probability of their collapse during strong earthquakes in the future. The San Fernando Veterans Administration Hospital buildings that collapsed are an example. Such buildings should be brought up to modern standards of seismic resistance, or they should be demolished. Because of the economic and human consequences of requiring repair or demolition, a phased program is recommended with those buildings that present the greatest hazard—relative to use, location and nature of construction—receiving the first and most urgent attention. This program also might include incentives to help ease the burden. The Commission believes that full compliance by 1980 is an achievable goal.

2. Unsafe Dams. The severe damage sustained by the old earthen dams, which retained the water of the lower and upper Van Norman Reservoirs, very nearly caused a catastrophe. All existing dams in California should be brought up to modern standards of safety or their use restricted.

3. Highway Structures. Present standards of earthquake design for highway bridges and other roadway structures should be revised and improved to conform with the current state of knowledge of earthquake engineering and should provide sufficient resistance to survive very strong shaking.

4. Code Revisions. Building-code provisions that require earthquake-resistant design have been in effect since the 1933 Long Beach earthquake. The greater survivability and increased protection of human life and limb provided in buildings constructed according to these newer code provisions are testimony to their efficacy. Nevertheless, the results of the February 9, 1971, earthquake indicate that further revision of building codes is needed to insure that the degree of damage will not be so great as to be hazardous to life and limb.

5. Facilities Vital in Emergencies. Certain types of structures and facilities, which are particularly important in post-disaster operations, such as hospitals, emergency power installations, emergency operating centers, public safety facilities and essential elements of key communications systems, should be designed and constructed to withstand strong earthquake shaking and yet be able to continue to function. Building codes should be amended to accomplish this.

6. Federal Construction. Federal action—which may include the enactment of legislation—must be taken to require that all construction by federal agencies, whether of new structures or the remodeling of older buildings, comply with local building-code provisions for earthquake resistance where the federal-agency building regulations are silent on the matter, or where such regulations

establish a standard that is below the minimum standard of the applicable local code.

7. Schools. While most modern school buildings performed very well during the earthquake, some potentially hazardous damage was sustained by a few of them. Such damage should be studied and the code requirements for earthquake resistance should be revised to eliminate these hazards. The use of old school buildings, which were not designed to resist earthquakes, should be prohibited until such buildings are brought up to modern standards of safety. If they cannot be made safe, they should be vacated immediately, even if classes must be held in tents.

8. Houses. Most typical, modern, one-story, wood-frame houses performed well during the earthquake ground shaking in that no severe hazard was created nor were the major economic losses widespread. Some modern, non-typical houses were severely damaged by earth shaking. Studies should be made of the applicable building-code specifications to work out practical revisions so as to improve the earthquake resistance of such houses.

9. Earthquake Insurance. Earthquake insurance should be made readily available to the homeowner by its inclusion in extended-coverage riders on "standard homeowners insurance" and on "standard fire" policies. It is recommended that all insurance underwriters use this form and that some method for reinsurance against catastrophic loss be provided, perhaps through Federal reinsurance and/or through a change in allowed reserves. Similar earthquake insurance should be made available to owners of small commercial buildings as well. Lending institutions should establish the principle that earthquake insurance—in California—is as essential as fire insurance.

10. Non-Structural Damage. Damage to non-structural building elements, such as partitions, ceilings and windows, and to electrical and mechanical equipment, was sustained in buildings that had adequate strength to resist the earthquake forces. Much of this damage was costly and potentially hazardous. Earthquake-resistant design and construction of such items must be improved.

11. Utilities. The results of the February 9 earthquake indicate that standards for designing and constructing utility systems—electric, water, gas, telephone, waste and sewers—should be reviewed and revised so that future earthquake damage will be within acceptable limits.

12. Instrumentation of Major Structures. The recordings of the strong-motion accelerographs, located in the general Los Angeles area, provided valuable engineering data about the seismic motions of the ground and of structures. These data will lead to improved methods of designing earthquake-resistant structures.

Many of these accelerographs were installed in major structures in the City

of Los Angeles as the result of legislation by the Los Angeles City Council. Jurisdictions, which do not require such instrumentation, should make it mandatory within their boundaries. Satisfactory maintenance and logical expansion of the strong-motion accelerograph network in Southern California must be encouraged.

13. Research. Research on earthquakes and their effects should be continued and encouraged, for only through such research can the understanding of earthquakes be increased and the ability to minimize their hazards be improved. All public authorities should cooperate with private and public agencies in collecting and publishing information concerning future earthquake probabilities. These authorities should support field work and studies in geology, geophysics, soil dynamics and physical response of structures to earthquakes.

14. Strong Ground Shaking and Faulting. Strong shaking during an earthquake typically extends over many square miles, while permanent fault dislocation is a very localized phenomenon. Therefore, a vastly greater number of structures will be affected by shaking than by quake damage, and the locations of faults are often unknown or poorly defined. Nevertheless, the building of structures directly across known active fault traces should be avoided whenever possible. Communications, transportation and utility lines should not be run along major active faults for long distances if feasible alternatives exist.

15. Emergency Operations for Earthquakes. Federal, State and local government agencies, the American Red Cross, and non-governmental groups and associations took effective measures to minimize the disastrous effects of the earthquake and recovery was rapid. However, weaknesses were noted in emergency operations that would have been magnified had this been a great earthquake. Governmental agencies performed independently at a time when coordination and team effort would have been mutually helpful. A need clearly was shown for local governments to provide emergency operating centers where information could be pooled and coordination achieved from a single, central location. Since such disasters usually affect many local governments, provision should be made within Los Angeles County for interjurisdictional coordination and exchange of information in the event of an emergency.

Radio communications systems must be constructed to survive strong ground shaking without loss of function.

On the basis of the February 9, 1971, experience, critical analyses and updating of plans, procedures and measures for coping with the effects of destructive earthquakes should be made. Responsible local officials should apply this experience to preparing for the possibility of an earthquake of very large magnitude.