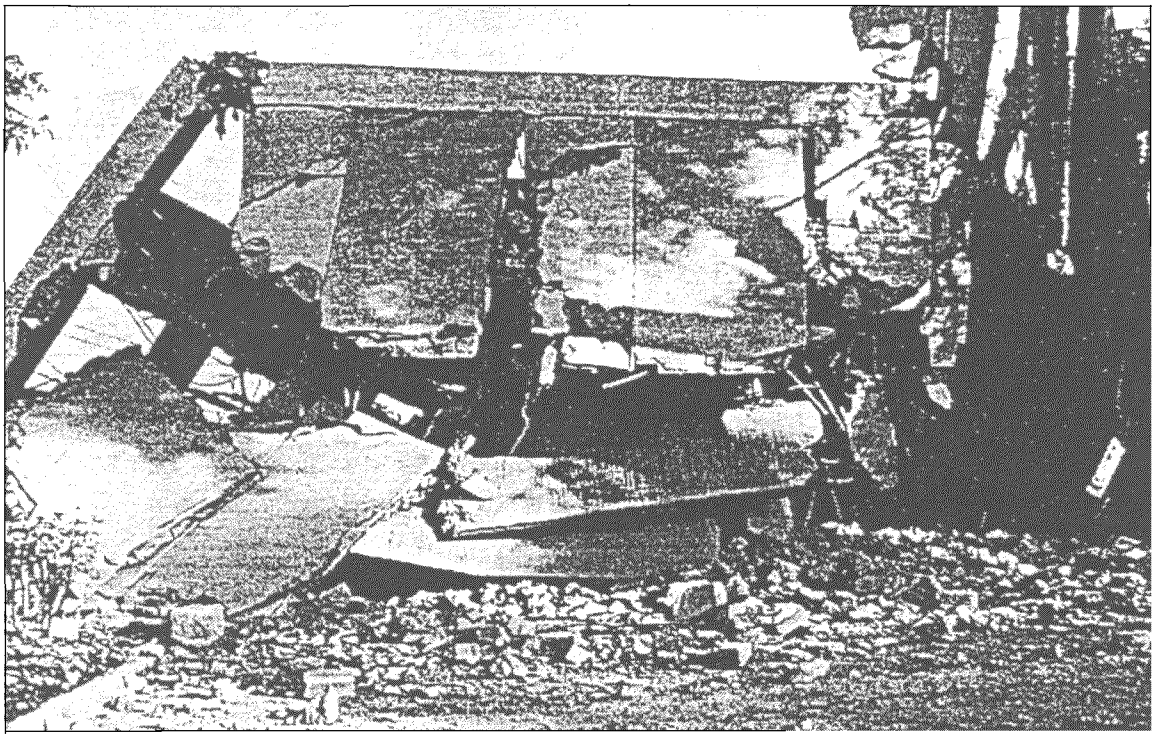

PHOTOGRAPH B7.9: Complete collapse of parking structure, Kaiser West Los Angeles Medical Center. *photo credit. Bob Reitherman, Earthquake Engineering Research Institute*

Based on a fax survey of area hospitals by the Hospital Council of Southern California (Reignor, 1994), which was updated 10 times in the days following the earthquake, some radio problems were caused by damage (one microwave tower was damaged, some radio equipment fell) while others were caused by human error (radios not plugged into outlets served by backup power, volume turned down too low for reception to be audible, messages requesting aid mishandled and not acted upon)

ISSUES AND ALTERNATIVES

Issue B7-a: Hospital Act provisions should be broadened so hospital performance will improve in future earthquakes.

The following five subissues concern the pre-1973 inventory of hospital buildings which, as was pointed out above, house about five-sixths of the hospital bed capacity.

Alternative B7-a.1

The state could intensify attempts to obtain voluntary improvements in the seismic protection of hospitals by development of educational and training materials and acceptable standards for retrofit.

This would be in essence a continuation of the current approach. For example, after the Loma Prieta Earthquake in 1989, OSHPD and the Building Safety Board sent a letter to all hospitals in the state outlining the problems that were brought out by the earthquake and recommending voluntary upgrades. (OSHPD, 1990) The items on that Seismic Checklist, with brief descriptions, were Structural Safety; Emergency Generator; Elevators, Water Supply; Communications; and Furniture, Fixtures and Equipment, a list that well covers the problems that surfaced in the Northridge earthquake. Two-day courses on hospitals and earthquakes, sponsored in California by the Federal Emergency Management Agency,

California Office of Emergency Services, and the Hospital Council, have been well attended.

pro: The Hospital Council and individual hospitals have generally opposed mandatory retrofits because of the cost issue, especially during the past decade when pressures have increased to cut expenses, so development of improved informational materials is the only solution.

con: The present approach is not working, as indicated by the unacceptable damage in the Northridge earthquake, the fact that advice distributed after Loma Prieta did not lead to retrofits, and statistics show only a very gradual attrition of the worst buildings. The only useful application of this idea would be to mandate training through JCAHO accreditation requirements as recommended by OES/FEMA (1990, p. 40).

Alternative B7-a.2

The state should carry out the SB 1953 program to gradually phase out or retrofit pre-Act buildings.

Seismic information on all nonfederal hospitals in the state, begun with field surveys in 1979 and completed along with analysis of the resulting data in 1991 (ATC, 1991a), provides the basis for an approximate initial diagnosis of the seismic problems of the approximately 500 hospitals in California on the gross basis of date of construction, type of structural system, and other data that are anonymous by facility. SB1953 (Alquist) requires pre-Act hospitals to come into substantial compliance over a 35-year time period in a manner very similar to the plan recommended in the Milestone 4 Report and current Five-Year Plan. (SSC, 1991c). Several other bills were also introduced shortly after the earthquake that would have significantly affected current seismic requirements of hospitals, but failed in committee.

pro: As with public schools (the state's retroactive Field Act/Garrison Act program) and unreinforced masonry buildings (various local government retrofit ordinances), the only way performance in future earthquakes will be significantly improved is to mandate retrofits.

con: Hospitals should not be singled out for mandatory retrofits—fire stations, large theaters, and many other building categories may represent equally significant risks. Also, the retrofit costs are unaffordable.

Alternative B7-a.3

The state could mandate that nonstructural systems necessary for post earthquake protection of patients, or for post earthquake service to the community, or both, be hardened, at least to the level of performance expected of the supporting structure.

Those systems that have proven particularly vulnerable and debilitating—sprinkler and other water lines, emergency power, large oxygen tanks, and telephone and radio communications—could be emphasized, rather than requiring upgrade to current code requirements for all the many nonstructural items in a modern hospital.

pro: For a small cost, the functionality of hospitals in future earthquakes could be greatly increased, and FEMA disaster mitigation grants would probably be available to subsidize the cost.

con: Even upgrading a few components would still be a significant cost, and only a complete upgrade of all systems would really ensure much better performance.

Alternative B7-a.4

The state could mandate that hospitals develop earthquake disaster plans that account for realistic scenarios of the post earthquake condition of their specific buildings, and the availability and reliability of water, power, communication, and other services.

Earthquake emergency planning requirements for hospitals are typically guided by nongovernmental Joint Council on Accreditation of

Healthcare Organizations (JCAHO) accreditation reviews that are necessary as a practical matter to keep a hospital in business in the United States. JCAHO requires two disaster exercises per year and a written disaster plan that is based on both an internal disaster (typically postulated as a fire) and an external disaster that would generate sudden medical demand (typically a plane crash). Earthquakes do not fit well into the existing JCAHO pattern devised for the typical American hospital, in that earthquakes are simultaneously an internal and external disaster. For example, Holy Cross or Olive View hospitals experienced water leaks, power and communications problems, etc. at the same time that people in the surrounding area were injured and needed treatment. Critiques of hospital earthquake exercises have frequently noted that the exercises are little different than the external disaster (say plane crash) exercises: Elevators are used to transport simulated patients, power is assumed to be normal, no allowance is made for overturned medical equipment, etc.

pro: Nationwide JCAHO accreditation requirements will never be influenced by the special needs of California concerning earthquakes, so the state must implement some minimal earthquake emergency planning requirements.

con: A variety of information is available for hospitals to use in voluntarily improving their disaster plans.

Alternative B7-a.5

The state could add provision of post-earthquake onsite utility capacity, such as water, power, and communications, as a retroactive requirement for hospitals

The Veterans Administration implemented a seismic construction standard, H-08-3, following the 1971 San Fernando earthquake, and also devised a standard for the onsite self-contained utility capacity for VA hospitals in earthquake-prone areas (VA CD 54). Four days' supply of water, fuel, and medical supplies is required, along with a number of items that are not apparent at first glance but are in fact required to keep the facility functional if outside services are lost: onsite garbage storage, backup power supply to pumps to move the backup supply of water where needed, etc. In the Northridge earthquake, utility outages were typically of short duration. While the entire City of Los Angeles lost electrical power, over 90 percent restoration was achieved within 24 hours. Telephone damage, or more typically telephone system call overload, also lasted about a day in most areas. Damage to underground pipeline systems—water, gas, sewer—typically required weeks to months to repair. Because of the moderate size of the earthquake (magnitude 6.8), only a relatively small area was shaken severely enough to cause utility infrastructure damage. Only 3 percent of the 490 hospital sites in the state have an earthquake-resistant backup supply of water, with necessary pumping capacity, to supply 50 gallons per bed per day for four days. (ATC, 1991b)

pro: Even an undamaged hospital will be unable[a], to function if advance provision has not been made for utility outages, such as adding means to quickly transfuse tanker truck supplies of water through the building system, or storing enough fuel on site for several days for the generator.

con: Backup supplies are expensive, and the state should instead put the burden on the utility systems to be able to rapidly restore service.

Issue B7-b: The performance of some post-Hospital Act hospital and other healthcare facilities was not up to the Act's expectations, and improvements are required with reference to these buildings and others that will be built in the future.

The following issues are the same as for pre-Act buildings above, but apply only to the nonstructural elements, because reexamination of structural design of post-Act buildings appears unjusti-

fied. For brevity, the discussions under the companion issues for older hospitals are not repeated.

Alternative B7-b.1

The state could intensify attempts to obtain voluntary improvements in seismic protection of hospitals by development of educational and training materials and acceptable standards for retrofit.

Although some systems have been identified as being vulnerable, requiring retrofit without the availability of techniques that have been confirmed by test or at least by engineering consensus may be unwise. This represents a more cautious approach, but one that would require some amount of funding.

pro: This cautious approach will pay off in the long run by avoiding retrofits that are not reliable.

con: Numerous data processing centers, electronics plants, office buildings, and other facilities around the state have already been retrofitted with current techniques found to be reliable

Alternative B7-b.2

The state could encourage OSHPD to continue to develop improved standards for nonstructural systems within their direct authority that proved vulnerable in the Northridge earthquake, such as sprinkler and water lines, elevators, emergency generators, oxygen tanks, and certain mechanical equipment, and implement these standards in the design of new buildings.

pro: California hospitals have special needs, and standards set for ordinary buildings (*e.g.* elevators or sprinklers) are not adequate.

con: Present standards are adequate, and it is burdensome when OSHPD requires use of standards that differ from what contractors are used to on other projects.

Alternative B7-b.3

The state could mandate that nonstructural systems necessary for post-earthquake protection of patients, or for post-earthquake service to the community, or both, be hardened, at least to the level of performance expected of the supporting structure.

Similar to Alternative B7-a3 for pre-Act buildings.

Alternative B7-b.4

The state could mandate that hospitals develop earthquake disaster plans that account for realistic scenarios of the post-earthquake condition of their specific buildings, and the availability and reliability of water, power, communication, and other services.

Similar to Alternative B7-a4 for pre-Act buildings.

Alternative B7-b.5

The state could add provision of post-earthquake emergency utilities such as water, power, and communications as a required and regulated element for all hospitals.

Similar to Alternative B7-a.5 for pre-Act buildings.