III. PACOIMA MEMORIAL LUTHERAN HOSPITAL

Pacoima Memorial Lutheran Hospital consisted of three sections: a three-story plus basement center section, a one and two-story north section, and a one-story south section (Figure 5). The structure was designed in 1958 under the Los Angeles City Building Code, and was designed to resist horizontal forces of about 10% of gravity. The building was constructed in 1959. Immediately adjoining the hospital, and connected by a one-story glass enclosed walkway, the two-story Golden State Mental Health Center was under construction and almost complete at the time of the earthquake.

Pacoima Memorial Lutheran Hospital contained 98 beds and 30 bassinets distributed as follows:

Second level:	34 semi-private beds
	2 private
Third level:	12 4-bed wards
	14 semi-private
	24 bassinets
	4 bassinets, premature
	2 bassinets, suspect
Fourth level:	12 4-bed wards
	22 semi-private
	2 private (isolation)

At the time of the earthquake there were 109 patients in the hospital. On the third floor there were 15-18 patients, including 3 patients in the labor room and 1 patient in delivery.

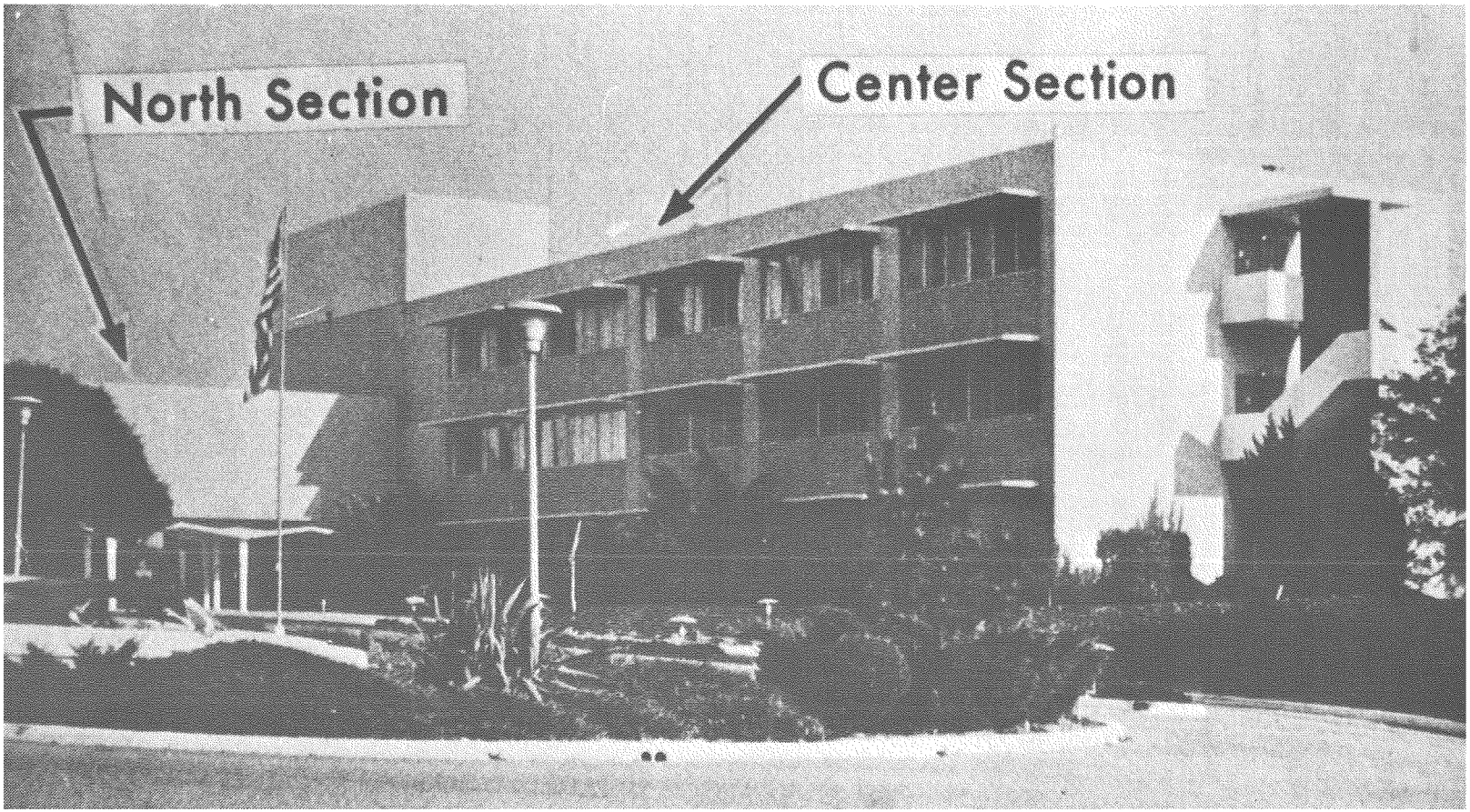

Figure 5: View of Pacoima Memorial Lutheran Hospital from the North, showing three story center section and two story north wing. (Photograph from: Lew, H.S., "Engineering Aspects of the 1971 San Fernando Earthquake," National Bureau of Standards, Washington, D.C., 1971).

a. Structure and Damage:

The hospital was constructed of reinforced concrete, using concrete pan joists for floor and roof. Lateral bracing for the three-story structure was provided by reinforced concrete shear walls at the short ends of the building together with a reinforced concrete elevator core and staircases at the East end that provided lateral resistance in the long directions. The one-story sections were braced by reinforced grouted brick masonry walls.

The two-story mental health center was constructed of reinforced brick masonry. The relatively poor soil conditions, consisting of soft unconsolidated alluvial materials, made it necessary for the building to be supported on piles which extended some 40 feet below the surface in order to provide sufficient vertical support to carry the weight of the superstructure. The pile foundation system of Pacoima Memorial Lutheran Hospital performed well in this regard; however, the surrounding soil settled about eight inches. When the building and its ground floor remained at the pre-earthquake elevation and the soil settled or subsided, in effect an 8 inch step was created around the base of the ground floor where before none existed.

Damage to the hospital building ranged from minor to major, although the three sections of the building were built at the same time. In this case other variables - especially the configuration of the units - determined their different damage states. The single story cafeteria and mechanical (plumbing and air-conditioning) services building suffered only one crack in an exterior wall, which was apparently due to pounding or hammering by the adjacent unit. The concrete block walls and plaster partitions of this unit were virtually undamaged. This good performance could have been largely predicted, due to the large amount of structural walls provided, the simple box shape, and the strong materials. Calculations by Degenkolb and Fratessa (4) indicate that low stresses would have been experienced, even with severe ground motion.

The four level nursing unit (including basement) is the tallest portion of the hospital and was heavily damaged; although there was no

collapse, widespread cracking occurred in concrete shear walls. One concrete stairway suffered structural damage: its walls cracked, but remained intact, and supporting beams were damaged. The building was initially evacuated and subsequently a large portion was demolished. Engineering analysis and field observations by Degenkolb and Fratessa attribute most of the damage in this portion of the building to the fact that it had a complex structural layout which did not evenly or rationally distribute forces as had been assumed when the building was designed.

To provide for future expansion, some concrete walls at the East end were designed as rectangular frames infilled with concrete "knock-out" panels so that the blank wall could be removed if a new wing was added. This introduced extra complication into the design since the structure had to be designed to resist earthquakes in its initial as well as final form, and some damage was attributed to the way this complicating factor was handled. In this case, only a detailed engineering analysis could have pinpointed such weaknesses.

Concrete block walls enclosing the elevators were also badly cracked. The walls were not intended to resist horizontal forces, but were rigidly connected to the rest of the building, and as the building moved slightly sideways the stiff concrete block walls quickly cracked. This is an example of the common problem of structural/nonstructural interaction: a concrete block wall may be intended merely a nonstructural fire resistant partition, but it is also a stiff wall, and unless it is either heavily reinforced or completely separated from the rest of the structure, damage will occur.

The third section accommodated the surgery and office areas of the hospital, on three levels. The first (basement) level was relatively undamaged as was the third level, but the middle story - with fewer walls - was badly damaged. Concrete block walls shattered, reinforced concrete columns cracked and pieces of concrete spalled off, and the floor slab at the entrance was badly cracked. For programmatic reasons, the solid shear walls which resisted horizontal forces were not lined up vertically through all the floors. The second level, which was the entrance level,

had fewer walls than other levels. Earthquake forces had to take circuitous routes as they travelled through the structure, and much of the severe damage was attributed to this factor.

The surgery and office unit of the complex illustrates the way in which a complex structural layout can create problems in an earthquake. In this case, one story performed significantly worse than the others; this probability would now be largely predictable by inspection of the building and could be incorporated into emergency plan provisions.

The two story Mental Health Center building suffered only minor damage. However, the utility tunnel beneath the walkway connecting this building to the main hospital suffered damage due to soil subsidence. As the soil vibrated and consolidated, it sank unevenly, with the result that the tunnel's concrete walls and roof were cracked and no longer exactly lined up vertically with the buildings at each end.