FIGURE 53.—Partial collapse of a three-story reinforced-concrete structure due to failure of columns in its second floor (Zone 12), Guatemala City.

(Penney, 1918; Seismological Society of America Bulletin, 1911–1975, vol. 8, no. 1, p. 38–39), was extensively damaged, and both front towers were on the verge of collapse.

A new church, Iglesia del Divino Redentor (fig. 54), sustained extensive damage, including collapsed roof and walls (Zone 11). The roof was supported from the bottom chord of steel trusses that failed and caused the collapse of the walls. The overlapping of vertical steel bars was done at the same level, and the separation of ties contributed to the weakness of the structure. Other churches were also seriously affected in Guatemala City, and some were completely or partially collapsed.

The Hotel Terminal (Zone 4), a reinforced-concrete frame, flat-slab, six-story building, collapsed when several columns at the third floor failed (fig. 55). Simple ties were used, and they were widely spaced. This column failure appears to be similar to failures seen in the upper story of the Student Union Building of the Universidad Agraria Nacional in Lima, Peru, after the October 3, 1974, earthquake (Husid and others, 1976).

Numerous gas-station structures, designed in the form of inverted pendulums, collapsed when the welding failed (fig. 56).

The International Airport building sustained minor damage, and, in one area, ground compaction occurred beneath the western part of the structure. An inspection of the airport building was made at the request of the airport commander. The two side concourses (fingers) off the main structure were designed as two-story inverted-pendulum-type structures. These fingers had one stair exit, a severe hazard in case of fire or earthquake.

Various elevated steel water tanks collapsed in Guatemala City and vicinity. Figure 57 shows one type of tank that suffered complete failure. Figure 58 shows the engineering plan of another type of elevated steel water tank (50,000-gallon capacity) that was used extensively throughout the city and failed in several locations. Three water tanks of this design that were full of water at the time of the earthquake collapsed (fig. 59). Two other tanks of this design that were empty sustained extensive damage; the anchor bolts had sheared, and most of the diagonal bracing failed.

A few corrugated-steel grain silos collapsed (fig. 60), and some that remained standing sustained extensive damage where they were connected to the foundation.

An inspection was made of the XAYA–PIXCAYA project, which, when it is completed, will provide water for Guatemala City. The sedimentation tank and the Plant Lo De Coy are located near Mixco. The main event, or possibly its aftershocks, created a new system of fractures that crosses beneath the sedimentation tank and other structures (fig. 61) These fractures may be related to renewed movements on an old fault. The existence of steep slopes in this area creates a potential for landslides, especially if cracks should develop in the sedimentation tank and water should leak into the ground.

Surface breakage on north- to northeast-striking secondary faulting (Zone 19) in Colonia San Francisco locally generated extensive damage to local residences (fig. 62).

In San José Rosario, a subdivision of Guatemala City, surface breakage with both vertical and right-lateral displacement occurred on a secondary fault parallel with the San Francisco fault. This surface rupture was in an area where plans have been made for construction of high-cost new homes (fig. 63).

Three central spans of the Agua Caliente Bridge, about 36 km northeast of Guatemala City, collapsed, but the piers remained undamaged. The spans were pinned at one end and had rocking rollers at the other. The failure appears to have been generated by the local failure of the supports caused by large