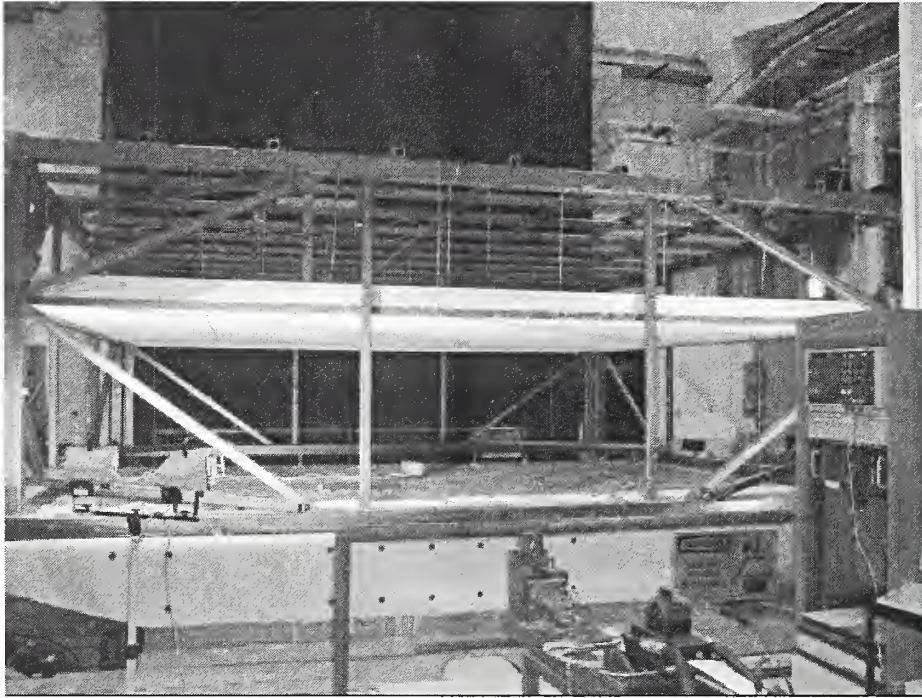


Accordingly, a series of tests of ceiling tile systems was conducted using the earthquake simulator (“shaking table”) at the University at Buffalo of the State University of New York. A detailed description of the hardware, procedures, and outcome of these tests can be found in NIST NCSTAR 1-5D. Figure 3-3 shows the test platform, the test frame, and a ceiling tile system.



Source: NIST.

Figure 3-3. Test frame mounted on the shaking table at the University at Buffalo.

The data indicated that accelerations on the order of 5g would cause serious distress to the ceiling tile systems, most likely resulting in substantial displacement of ceiling tiles. Comparison of this result to the building accelerations obtained from dynamic modeling of the impact of the aircraft with the towers must take into account that these tests were not exact replications of the initiating events on September 11, 2001:

- The installed ceiling tile systems in the WTC towers had been in service for up to 30 years, and during that time, the buildings had been subjected to wind forces that swayed the towers. Several occupants have reported that high winds resulted in falling ceiling tiles (NIST NCSTAR 1-7). Thus, the frames were not in the new condition of the systems tested here.
- The boundary conditions in the test frame were not identical to the in-service boundary conditions in the towers at the times of the aircraft impacts. The ceiling tile system was far more extensive in the towers.

The estimated accelerations from the aircraft impacts were on the order of 100g (NIST NCSTAR 1-2). It is thus likely that numerous ceiling tiles were dislodged throughout the focus floors, a finding that is consistent with the multiple reports of severely damaged ceilings (NIST NCSTAR 1-7). When even a moderate fraction of the ceiling tiles are displaced, the hot fire smoke will quickly enter the exposed plenum, and thus in the modeling of the fires it was assumed that the ceiling tile system was absent.