

Chapter 13

THE PROBABLE COLLAPSE SEQUENCE

13.1 SUMMARY PROBABLE COLLAPSE SEQUENCE

1. **Collapse of the WTC Towers.** The collapse of WTC 2 did not cause any structural damage or start any fires in WTC 7. The collapse of WTC 1 damaged seven exterior columns on the lower floors of the south and west faces and initiated fires on at least 10 floors between Floors 7 and 30.
2. **Growth and Spread of Fires.** Fires on the lower floors (Floors 7 to 9 and 11 to 13) grew and spread since they were not extinguished either by the automatic sprinkler system or by FDNY because water was not available. By 3:00 p.m. to 4:00 p.m., these fires were generally concentrated on the east and north sides of the northeast region. The local fires on the upper floors (Floors 19, 22, 29, and 30) were not observed after approximately 1 p.m.
3. **Initial Local Failure for Collapse Initiation.** Fire-induced thermal expansion of the floor system surrounding Column 79 led to collapse of Floor 13 that triggered a cascade of floor failures. This, in turn, led to loss of lateral support to Column 79 over nine stories, resulting in the buckling failure of Column 79.
4. **Vertical Progression of Failure.** The buckling of Column 79 (the collapse initiation event) triggered a vertical progression of floor system failures to the east penthouse and subsequent cascading failure of the adjacent interior columns on the east side of the building (i.e., Columns 80 and 81). The vertical progression of floor system failures spread to include the entire east region all the way to the top of the building.
5. **Horizontal Progression of Failure.** The interior columns buckled in succession from east to west in the lower floors due to loss of lateral support from floor system failures, forces exerted by falling debris, and load redistributed from other buckled columns.
6. **Global Collapse.** The exterior columns buckled at the lower floors (between Floors 7 and 14) due to load redistribution to the exterior columns from the downward movement of the building core. The entire building above the buckled-column region then moved downward in a single unit, as observed, completing the global collapse sequence.
7. **Other Possible Hypotheses.**
 - Fuel oil fires did not contribute to the collapse of WTC 7.
 - Hypothetical blast events did not contribute to the collapse of WTC 7. NIST concluded that blast events could not have occurred and found no evidence of any blast events.
 - The Con Edison substation played no role in the fires that caused the collapse of WTC 7.