

81. An east-to-west horizontal progression of interior column buckling followed, due to loss of lateral support to adjacent columns, forces exerted by falling debris, and load redistribution from other buckled columns. The exterior columns then buckled as the failed building core moved downward, redistributing its loads to the exterior columns. Global collapse occurred as the entire building above the buckled region moved downward as a single unit.

- The collapse of WTC 7 was a fire-induced progressive collapse. The American Society of Civil Engineers defines progressive collapse—also known as disproportionate collapse—as the spread of local damage, from an initiating event, from element to element, eventually resulting in the collapse of an entire structure or a disproportionately large part of it (ASCE 7-05). Despite extensive thermal weakening of connections and buckled floor beams of Floors 8 to 14, fire-induced damage in the floor framing surrounding Column 79 over nine stories was the determining factor causing the buckling of Column 79 and, thereby, initiating progressive collapse. This is the first known instance where fire-induced local damage (i.e., buckling failure of Column 79; one of 82 columns in WTC 7) led to the collapse of an entire tall building.
- WTC 7 was prone to classic progressive collapse in the absence of debris impact and fire-induced damage when a section of Column 79 between Floors 11 and 13 was removed. The collapse sequence demonstrated a vertical and horizontal progression of failure upon the removal of the Column 79 section, followed by buckling of exterior columns, which led to the collapse of the entire building.
- Neither the transfer elements (trusses, girders, and cantilever overhangs) nor the “strong” floors (Floors 5 and 7) played a significant role in the collapse of WTC 7. Neither did the Con Edison substation play a significant role in the collapse of WTC 7.
- There was no evidence to suggest that there was damage to the SFRM that was applied to the steel columns, girders, and beams, except in the vicinity of the structural damage from the collapse of WTC 1, which was near the west side of the south face of the building.
- Even without the initial structural damage caused by debris impact from the collapse of WTC 1, WTC 7 would have collapsed from fires having the same characteristics as those experienced on September 11, 2001.
- Early fires in the southwest region of the building did not play a role in the collapse of WTC 7. The fires in this region were not severe enough to heat the structure significantly; and, unlike the northeast region where collapse initiated, there were no columns supporting long span floors in the southwest region.
- The observed descent time of the upper 18 stories of the north face of WTC 7 (the floors clearly visible in the video evidence) was 40 percent greater than the computed free fall time. A more detailed analysis of the descent of the north face found three stages: (1) a slow descent with acceleration less than that of gravity that corresponded to the buckling of the exterior columns at the lower floors, (2) a freefall descent over approximately eight stories at gravitational acceleration for approximately 2.25 s, and (3) a decreasing acceleration as the north face encountered resistance from the structure below.