

contributed to the failure of the critical north-south girder were (1) the absence of shear studs that would have provided lateral restraint and (2) the one-sided framing of the east floor beams that allowed the beams to push laterally on the girders, due to thermal expansion of the beams.

- The fires thermally weakened Floors 8 to 14. As Floor 13 fell onto the floor below, a cascade of floor failures continued until the damage reached the massive Floor 5 slab, leaving Column 79 without lateral support for nine floors. The long unsupported length of Column 79 led to its buckling failure.
- Blast events did not play a role in the collapse of WTC 7. NIST concluded that blast events could not have occurred, and found no evidence whose explanation required invocation of a blast event. Blast from the smallest charge capable of failing a critical column (i.e., Column 79) would have resulted in a sound level of 130 dB to 140 dB at a distance of at least half a mile if unobstructed by surrounding buildings (such as along Greenwich Street and West Broadway). This sound level is comparable to a gunshot blast, standing next to a jet plane engine, and more than 10 times louder than being in front of the speakers at a rock concert. The sound from such a blast in an urban setting would have been reflected and channeled down streets with minimum attenuation. However, the soundtracks from videos being recorded at the time of the collapse did not contain any sound as intense as would have accompanied such a blast.

Vertical Progression of Collapse

- Once Column 79 buckled, there was a vertical progression of floor system failures up to the east penthouse, followed by the buckling of Columns 80 and 81.
 - The buckling of Column 79 at the lower floors led to downward movement of the upper section of Column 79. The adjacent floor framing was pulled downward, leading to the observed kink in the east penthouse roof framing.
 - As the lower floors surrounding Column 79 fell downward, Column 80 and Column 81 had increased unsupported lengths as well as falling debris impacts and loads being redistributed from adjacent columns. This led to buckling of Columns 80 and 81, and resulted in a vertical progression of failure of the floor systems up to the roof level across the entire east side of WTC 7.
- Columns 79, 80, and 81 were the only interior support for the gravity loads in the eastern region of the building. Once these three columns buckled and their upper sections began to descend, there was insufficient support for the floors, up to the east penthouse.
- None of these columns was significantly weakened by elevated temperatures; temperatures did not exceed 300 °C (570 °F) in the core or perimeter columns in WTC 7.