

Global Collapse

After the horizontal progression of column buckling in the core of WTC 7, the exterior columns buckled at the lower floors, completing the global collapse sequence as follows:

- As the interior columns failed, the exterior columns on the west face buckled inward at the lower floors as a result of floor pull-in forces due to the downward movement of the building core. The floor connections to the columns had not failed in this region because there were no fires observed on the west side on Floors 10 through 14 at any time during the day, and the intact floors were able to pull the exterior columns inward.
- Exterior column buckling began at Column 14, adjacent to the debris impact zone near the southwest corner, between Floors 10 and 12. The exterior columns adjacent to the seven columns severed in the southwest region due to the collapse of WTC 1 were the first to buckle because additional load was distributed to them following the debris impact damage.
- The south and west exterior columns buckled first, followed by the north and east face columns.
- All exterior columns buckled between approximately Floors 7 and 14.
- Once column support was lost in the lower floors, the remaining exterior structure above began to fall vertically as a single unit.

The buckling of the interior columns in the global collapse analysis was followed by the buckling of the exterior columns.

Figure 12–60 shows a schematic view of Floor 8 that highlights the exterior columns that were used to track the column load history for each face. Also noted on the figure is the debris impact zone from the collapse of WTC 1, which shows the southwest columns that were severed. Loads were extracted just above Floor 8 for three columns per face and were averaged to generate the loads shown in Figure 12–61.

Figure 12–61 shows that selected exterior column forces increased as gravity loads were applied (compressive loads are negative). As indicated at 4.5 s (LS-DYNA calculation time), there was an increase in compressive forces on the west and south faces of the building after debris impact damage was applied. As Columns 79, 80, and 81 buckled and the floor systems failed on the east side of the building (at 15 s to 16 s), column forces reduced in the north and east faces. The west face column forces were dominated by the forces in Column 14, which was adjacent to the severed columns in the southwest corner. At 21.5 s, exterior column buckling began at Column 14, between Floors 10 and 12. The exterior columns adjacent to the (seven) columns severed in the southwest region due to the collapse of WTC 1 were the first to buckle due to the increased forces in these columns following the debris impact damage. The south and west face columns buckled first, followed by the north and east face columns.