

- Restraint provided by exterior and core columns, which extended one floor above and below the modeled floor. The potential for large deflections and buckling of individual structural members and the floor system were included.

The results showed that:

- At lower elevated temperatures (approximately 100 °C to 400 °C), the floors thermally expanded and displaced the exterior columns outward by a few inches; horizontal displacement of the core columns was insignificant. None of the floors buckled as they thermally expanded, even with the exterior columns restrained so that no horizontal movement was allowed at the floors above and below the heated floor, which maximized column resistance to floor expansion. Even with this level of column restraint, the exterior columns did not develop a sufficient reaction force (push inward to resist the expansion outward) to buckle any of the floors.
- At higher elevated temperatures (above 400 °C), the floors began to sag as the floors' stiffness and strength were reduced with increasing temperature, and the difference in thermal expansion between the trusses and the concrete slab became larger. As the floor sagging increased, the outward displacement of the exterior columns was overcome, and the floors exerted an inward pull force on the exterior columns.
- Floor sagging was caused primarily by either buckling of truss web diagonals or disconnection of truss seats at the exterior wall or the core perimeter. Except for the truss seat failures near the southeast corner of the core in WTC 2 following the aircraft impact, web buckling or truss seat failure was caused primarily by elevated temperatures of the structural components.
- Analysis results from the detailed truss model found that the floors began to exert inward pull forces when floor sagging exceeded approximately 25 in. for the 60 ft floor span.
- Sagging at the floor edge was due to loss of vertical support at the truss seats. The loss of vertical support was caused in most cases by the reduction in vertical shear capacity of the truss seats due to elevated steel temperatures.
- Case B impact damage and thermal loads for WTC 1 floors resulted in floor sagging on the south side of the tower over floors that reasonably matched the location of inward bowing observed on the south face. Case A impact damage and thermal loads did not result in sagging on the south side of the floors.
- Cases C and D impact damage and thermal loads for WTC 2 both resulted in floor sagging on the east side of the tower over floors that reasonably matched the location of inward bowing observed on the east face. However, Case D provided a better match.