

- Both WTC 1 and WTC 2 were stable after the aircraft impact, standing for 102 min and 56 min, respectively. The global analyses with structural impact damage showed that both towers had considerable reserve capacity. This was confirmed by analysis of the post-impact vibration of WTC 2, the more severely damaged building, where the damaged tower oscillated with a peak amplitude that was between 30 percent and 40 percent of the sway under hurricane force winds for which the towers were designed and at periods nearly equal to the first two translation and torsion mode periods calculated for the undamaged structure.
- Computer simulations, supported by the results of large-scale fire tests and furnace testing of floor subsystems, showed that insulated structural steel, when coated with the average installed insulation thickness of $\frac{3}{4}$ in., would not have reached high temperatures (i.e., greater than 650 °C) from nearby fires for a longer time than the burnout time of the combustibles (approximately 20 min for 4 lb/ft² of combusted material). Simulations also showed that variations in thickness resulting from normal application, even with occasional gaps in coverage, would not have changed this result.
- Inward bowing of the exterior walls in both WTC 1 and WTC 2 was observed only on the face with the long-span floor system. In WTC 1, this was found to be the case even though equally extensive fires were observed on all faces. In WTC 2, fires were not observed on the long-span west face and were less intense on the short-span faces than on the east face.
- Inward bowing was a necessary but not sufficient condition to initiate collapse. In both WTC 1 and WTC 2, significant weakening of the core due to aircraft impact damage and thermal effects was also necessary to initiate building collapse.
- The tower structures had significant capacity to redistribute loads (a) from bowed walls to adjacent exterior walls with short-span floors via the arch action of spandrels, and (b) between the core and exterior walls via the hat truss and, to a lesser extent, the floors.

In evaluating how the undamaged towers would have performed in an intense, conventional fire, NIST considered the following factors individually and in combination:

- The *temperatures* that would be reached in structural steel components with intact insulation.
- The *extent of the area* over which high temperatures (e.g., greater than 600 °C where significant thermal weakening of the steel occurs) would be reached at any given time.
- The *duration* over which the high temperatures would be sustained concurrently in any given area.
- The *length of the floor span* (long or short) where high temperatures would be reached.
- The *number of floors* with areas where high temperatures would be sustained concurrently in the long-span direction.