

10.4 FINDINGS FROM THE CALCULATED FIRE-INDUCED THERMAL RESPONSE OF WTC 7

Imposing the heat from the simulated WTC 7 fires floor on the building structure led to significant heating of some structural components. Other structural components, particularly columns, remained relatively cool. FSI calculations were performed using the temperatures directly from the FDS simulations (Case A), temperatures that were 10 percent larger than the FDS temperatures (Case B), and temperatures that were 10 percent lower than the FDS temperatures (Case C). The temperatures in the latter two Cases were within the expected range of realistic and reasonable fire-generated temperatures.

The following is a list of findings common to the three Cases:

- In none of the Cases did any of the columns, all of which were insulated, reach temperatures sufficiently high for significant loss of strength or stiffness.
 - The temperatures of Columns 79, 80, and 81 stayed below 200 °C on all of the floors.
 - Only on Floors 12 and 13 did any of the exterior column temperatures exceed 150 °C. On these floors, the temperatures on the east and south exterior columns reached 300 °C.
- The fires on the 7th, 12th, and 13th floors heated portions of the tops of the floor slabs to over 900 °C. In all cases, significant temperature gradients were observed through the thickness of the concrete slab.
- The temperatures of some sections of the floor beams supporting the 8th, 12th, 13th, and 14th floor slabs exceeded 600 °C, except for the 8th floor beams in Case C. The temperatures of some sections of the floor beams supporting the 9th and 10th floors reached 400 °C.

For each of the three cases, Table 10–1 indicates, in blue, those regions of the steel structure that reached a temperature at which nominally half the steel strength remains. It also indicates, in blue, the regions where the tops of the floor slabs reached a similar temperature. An arrow connecting two regions indicates a moving hot zone; a comma connecting two regions indicates both were heated simultaneously.

For the Case B computation, the following characteristics were observed relative to Case A results.

- The peak temperatures in the tops of the floor slabs increased by about 80 °C. The peak temperatures in the floor beams increased by about 75 °C.
- The floor area over which the temperatures of the supporting beams exceeded 600 °C increased significantly.
- The overlap between adjacent floors of these > 600 °C zones increased significantly.
- The change in the temperatures of the exterior and core columns was not significant.