

To overcome these difficulties, NIST developed the Fire Structure Interface (FSI). To use the FSI with a set of FDS-calculated gas phase temperatures:

- The compartment was divided into a hot, soot-laden upper layer and a cool, clear lower layer.
- Explicit formulae for the radiative heat flux were obtained as a function of temperature, hot layer depth, soot concentration, and orientation of each structural element.
- Structural components in the hot layer were also subject to convective fluxes based on the difference between their surface temperature and the local hot layer temperature.
- The thermophysical properties of the steel in the structural elements and of the SFRM were obtained from published data and new data developed under the Investigation.
- The resulting data set was subsequently read into the ANSYS 8.0 finite element program, which generated the thermal distribution within the structural elements.

The “transparency” of FSI was estimated by comparison of FDS-FSI predictions of steel and SFRM surface temperatures with those obtained in the steel element exposure tests. The FSI appeared to add little to the overall uncertainty in the simulation of the temperatures at the outer surfaces of bare steel elements and the surfaces of SFRM and, more importantly, at the SFRM-steel interface. On the average, the numerical predictions of the steel surface temperature were within 7 percent of the experimental measurements for bare steel elements and within 17 percent for the insulated steel elements. The former was determined to result from uncertainty in the heat release rate in the fire model. The increase in the latter was attributed to model sensitivity to the SFRM coating thickness and thermal conductivity.

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The simulations of the fires and of their heating of the building structure were the second and third computational steps, respectively, in the identification of the probable sequences leading to the collapses of the towers. They followed the simulation of the aircraft impacts and preceded the analysis of the behavior of the damaged and heated building structures.

After a number of simulations to gain insight into the factors having the most influence on the nature of the fires, for each tower, two fire scenarios (Case A and Case B for WTC 1 and Case C and Case D for WTC 2) were superimposed on two aircraft-driven damage patterns. For each of the four scenarios, FDS was used to generate a time-dependent gas temperature and radiation environment on each of the floors. The following apply to all the Cases:

- Eight floors were modeled in WTC 1 (92 through 99) and six floors were modeled in WTC 2 (78 through 83). Each floor was modeled separately, since examination of the photographic collection indicated little evidence for floor-to-floor fire spread in the times that the towers survived. Heat conduction through the floors was included.