

(i.e., after approximately 1,000 s). The largest deviation was for the temperatures on the north side of the column in Test 5. This was due to the FDS underprediction of the asymmetry of the fire plume which was close to the column.

- For the bar and the column, the maximum difference between the measurements and the simulations of the bare steel surface temperatures was less than 15 percent, which generally occurred shortly after the fuel flow was stopped. For the north truss, the maximum difference between the measurements and the simulations was typically less than 20 percent. At one location, however, the temperature difference was as large as approximately 30 percent. The reason for the magnitude of this difference appeared to be due to subtleties associated with predicting the exact location of the flame as mentioned previously. Other reasons for the differences between the numerical simulations and the temperature measurements are discussed below in terms of the uncertainty in the measurements and a sensitivity analysis of the model.
- For the bar, the quality of the predictions of the SFRM surface temperatures and the steel surface temperatures with and without SFRM was the same. This indicated that for a simple geometry, the FSI was not adding significant uncertainty to that from the temperature measurements and the FDS simulations.
- For the more complex column and truss, the disparities were about an additional 15 percent higher.
- The computations more frequently underpredicted the temperatures.

The FSI calculations were sensitive to:

- The fire heat release and the resulting upper layer temperatures. A sensitivity study showed that a 10 percent increase in the heat release rate led to a 20 percent increase in the steel surface temperature at the hottest locations.
- The proximity of the structural components to the fire. FDS did a better job predicting the heat flux to locations far from the fire, because the size, spatial extent, and precise location of the fire had less influence on the results.
- Variability in the thickness of the SFRM. The calculations assumed that the mean value was uniform throughout. As applied, the SFRM had a coefficient of variation that ranged from 0.17 to 0.27 for the bars, columns, and trusses. A 25 percent decrease in the thickness of the SFRM increased the steel temperatures by approximately 10 percent. In these tests, the local SFRM thickness on some sections of the bars was smaller than the mean by as much as 45 percent. This indicates that the variation in the calculated steel surface temperature was as much as 20 percent simply from uncertainty in the SFRM thickness.
- The thermal conductivity of the SFRM. Typical uncertainty in the determination of thermal conductivity using ASTM tests was ± 6 percent for materials similar to the BLAZE-SHIELD SFRM (NIST NCSTAR 1-6A).