

NIST performed confirmatory tests on samples of the 236 pieces of recovered steel to determine if the steel met the structural specifications. Making a definitive assessment was complicated by overlapping specifications from multiple suppliers, differences between the NIST test procedures and the test procedures that originally qualified the steel, the natural variability of steel properties, and damage to the steel from the collapse of the WTC towers. Nonetheless, the NIST investigators were able to determine the following:

- There were 14 grades (strengths) of steel that were specified. However, a total of 32 steels in the impact and fire floors were sufficiently different (grade, supplier, and gage) to require distinct models of mechanical properties.
- The steels in the perimeter columns met their intended specifications for chemistry, mechanical properties, yield strengths, and tensile properties. The steels in the core columns generally met their intended specifications for both chemical and mechanical properties.
- Roughly 13 percent of the measured strength values for the perimeter and core columns were at or below the specified minimums (Figure 5–4). The strength variation was consistent with the historical variability of steel strength and with the effects from damage during the collapse of the towers. The measured values were within the typical design factor of safety.
- The yield strengths of many of the steels in the floor trusses were above 50 ksi, even when they were specified to be 36 ksi.
- Tests on a limited number of recovered bolts showed they were much stronger than expected based on reports from the contemporaneous literature.

The mechanical properties of steel are reduced at elevated temperatures. Based on measurements and examination of published data, NIST determined that a single representation of the elevated temperature effects on steel mechanical properties could be used for all WTC steels. Separate values were used for the yield and tensile strength reduction factors for bolt steels.