

then covered with gypsum wallboard. The planks were likely custom fabricated for this job, as the investigators found no mention of similar products in gypsum industry literature of the time or since.

5.5 STRUCTURAL STEELS

5.5.1 Types and Sources

Roughly 200,000 tons of steel were used in the construction of the two WTC towers. The building plans called for an unusually broad array of steel grades and multiple techniques for fabricating the structure from them. The NIST team obtained the information needed to characterize the steels from structural drawings provided by The Port Authority, copies of correspondence during the fabrication stages, steel mill test reports, interviews with fabrication company staff, search of the contemporaneous literature, and measurements of properties at NIST. Sorting through this immense amount of information was made difficult by the large number of fabricators and suppliers, the use of proprietary grades by some of the manufacturers; and the fact that the four fabricators of the impact and fire floor structural elements no longer existed at the time of this Investigation.

Fortunately, the potential for confusion had led the building designers to a tracking system whereby the steel fabricators stamped and/or stenciled each structural element with a unique identifying number. The structural engineering drawings included these identifying numbers as well as the yield strengths of the individual steel components. Thus, when NIST found the identifying number on an element such as a perimeter column panel, the particular steel specified for each component of the element was known, as well as the intended location of the steel in the tower.

In all, 14 grades of steel were specified in the structural engineering plans, having yield strengths from 36 ksi to 100 ksi. Twelve were actually used, as the fabricators were permitted to substitute 100 ksi steel where yield strengths of 85 ksi and 90 ksi were specified. Table 5–1 indicates the elements for which the various grades were used. The higher yield strength steels were used to limit building weight while providing adequate load-carrying capacity.

Table 5–1. Specified steel grades for various applications.

Application	Yield Strength (ksi)											
	36	42	45	46	50	55	60	65	70	75	80	100
Perimeter columns	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Spandrel plates	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Core columns	✓	✓	(a)		(a)							
Floor trusses	✓				✓							

a. About 1 percent of the wide flange core columns were specified to be of these higher grades.

5.5.2 Properties

The Port Authority required a thorough and detailed quality assurance programs to ensure compliance with the specifications for the steel, welds, and bolts. The steel data went beyond the minimum yield strength (the property of greatest importance) to include tensile strength and ductility. The quality assurance program included unannounced inspections and confirming tests.