

- The demand/capacity ratios (DCRs) of the columns, estimated from the original WTC design loads, were in general close to those obtained under current wind design practice. The DCRs for over 99 percent of the floor trusses and beams were less than unity as they should have been. The safety of the WTC towers on September 11, 2001 was most likely not affected by the fraction of structural members for which the demand exceeded allowable capacity due to: (1) the factor of safety in the allowable stress design method, (2) the load redistribution capability of the steel structures, and (3) the towers having been subjected to lighter than routine live loads and minimal wind loads at the time of the attacks.
- Under a combination of the original WTC design dead and wind loads, tension forces were developed in the exterior walls of both towers. The forces were largest at the base of the building and at the corners. The Investigation showed that the DCRs for the exterior wall splice connections were less than 1.0.
- For the towers' resistance to shear sliding under wind loads, the factor of safety was between 10 and 11.5, while the factor of safety against overturning ranged from 1.9 to 2.7 for both towers.
- The period of natural building oscillations calculated from the reference global model of the WTC 1 matched well those determined from accelerometers located atop the tower. This lent credence to the global models of the towers.

8.5.3 Fire Safety

- By being consistent with the proposed 1968 edition of the NYC Building Code, rather than the requirements of the 1938 Code, the tower design:
 - Eliminated a fire tower¹⁶ (also called a smoke-proof stairway) as a required means of egress;
 - Reduced the number of required stairwells from 6 to 3 (see discussion in Section 5.35) and the size of doors leading to the stairs from 44 in. to 36 in.;
 - Reduced the fire rating of the shaft walls in the building core from 3 hours to 2 hours; and
 - Permitted a 1 hour reduction in fire rating for all structural components (columns from 4 hours to 3 hours and floor framing members from 3 hours to 2 hours) by allowing the owner/architect to select Class 1B construction for business occupancy and unlimited building height.

Many of these allowances in the 1968 NYC Building Code are contained in current codes.

¹⁶ A fire tower (also called a smoke-proof stair) is a stairway that is accessed through an enclosed vestibule that is open to the outside or to an open ventilation shaft providing natural ventilation that prevents any accumulation of smoke without the need for mechanical pressurization.