

The compressive strains in the southeast area of the slab for Floor 12 gradually increased to exceed the crushing criterion ($\epsilon > 0.004$) and covered the full east side and half of the south side of the tenant floor area. The compressive strains in the southeast and east slab areas for Floor 13 exceeded the crushing criterion, and the damage to the slab extended westward on the south face. As a result, slab elements were removed from the model. Due to the large area of failed floor beams, the slab was unsupported over a large area and was not able to carry its loads. A portion of the slab was removed, and the mechanical strains were set to zero.

Column Forces. Figure 11–37 shows the axial force in columns at Floor 8 at 4.0 h. The axial forces in columns were reduced by less than 0.50 percent relative to the gravity load analysis. This reduction was due to the self-weight of the removed beams. At the end of 4.0 h, the change in axial column forces was still negligible, as expected.

Summary. After 4.0 h of heating, Columns 79, 80, and 81 had lost lateral support in the north-south direction at Floor 13, due to failure of the girders between the columns. The girders between Columns 80 and 81 had buckled and the girders between Columns 79 and 44 and Columns 26 and 81 had walked off the bearing seat at Column 79 and 81, respectively. In addition, all of the bolts had sheared at Column 79 on Floor 14, and two to three bolts had sheared on Floor 12. Approximately one-half to three-quarters of the east floor beams had a connection damage index of 0.75-0.99 on Floors 11, 12, and 14 and all of the east floor beams had failed on Floor 13. After 4.0 h of heating, there was substantially more damage and failures in the WTC 7 structural system than after 3.5 h of heating. Columns 79, 80, and 81 had lost lateral support at one or more floors.

The impact of a floor section falling on the floor below was not analyzed in the 16 story ANSYS model, but was simulated in the 47 story LS-DYNA model (Chapter 12).