

- The second model, an explicit analysis developed using LS-DYNA, estimated the structural response of the full 47 story structure to the initial failure event due to fire (from the 16 story ANSYS model), and the vertical and horizontal progression of failures that led to global collapse of WTC 7 (Chapter 12). This model accounted for the potential for progressive collapse in the building, including buckling of columns due to loss of lateral restraint, dynamic effects associated with failure progression, and impact of falling floors. The progressive collapse analysis captured the vertical progression of failure, horizontal progression of failure, and global collapse.

The three thermal response cases (A, B, and C) were used in the ANSYS analysis. Based on ANSYS model results, it became apparent as each of the analyses progressed that the sequential failures that were occurring were at essentially the same locations and with similar failure mechanisms. However, as might be expected, the failures were shifted in time, i.e., Case C failures occurred at a later time than the same failures in Case A, and Case A failures occurred at a later time than Case B failures. As a result, only the fire-induced damage produced by Case B temperatures was carried forward as the initial condition for the LS-DYNA analysis (Chapter 12), since the damage occurred in the least computational time (about 6 months).

1.3 WTC 7 REPORTS

This report, NIST NCSTAR 1-9, is a detailed technical report of the investigation and analyses. It is written for technical experts in each of the relevant disciplines. The following reports further document the investigation of the collapse of WTC 7.

NIST NCSTAR 1A is a final summary report of the investigation of the collapse of WTC 7, and includes an accounting for readers who are not experts in each of the disciplines relevant to the investigation. It also includes the NIST recommendations to reduce the severity of the outcome of future mishaps in tall buildings.

NIST NCSTAR 1-9A is a detailed technical report of the LS-DYNA model development and analyses. This report is summarized in Chapter 12 of this report.

Previous Investigation reports that documented WTC 7 conditions or events include:

NIST NCSTAR 1-1, summarized the design, construction, and maintenance of structural and life safety systems in WTC 7, as well as the WTC towers. Additional details on these subjects for WTC 7 can be found in the following technical reports:

- NIST NCSTAR 1-1A: Design and Construction of Structural Systems
- NIST NCSTAR 1-1C: Maintenance and Modifications to Structural Systems
- NIST NCSTAR 1-1D: Fire Protection and Life Safety Provisions Applied to the Design and Construction and Post-construction Provisions Applied after Occupancy
- NIST NCSTAR 1-1E: Comparison of Codes, Standards, and Practices in Use at the Time of the Design and Construction