

This analysis showed that WTC 7 was prone to classic progressive collapse upon the failure of Column 79. WTC 7 was not evaluated for progressive collapse, as it was not (and still is not) standard practice to evaluate commercial office buildings for such an event. Unless a potential hazard is known, a typical progressive collapse analysis includes a critical failure location and identifies areas where the structural design could be strengthened or made more redundant to mitigate against a global or disproportionately large collapse.

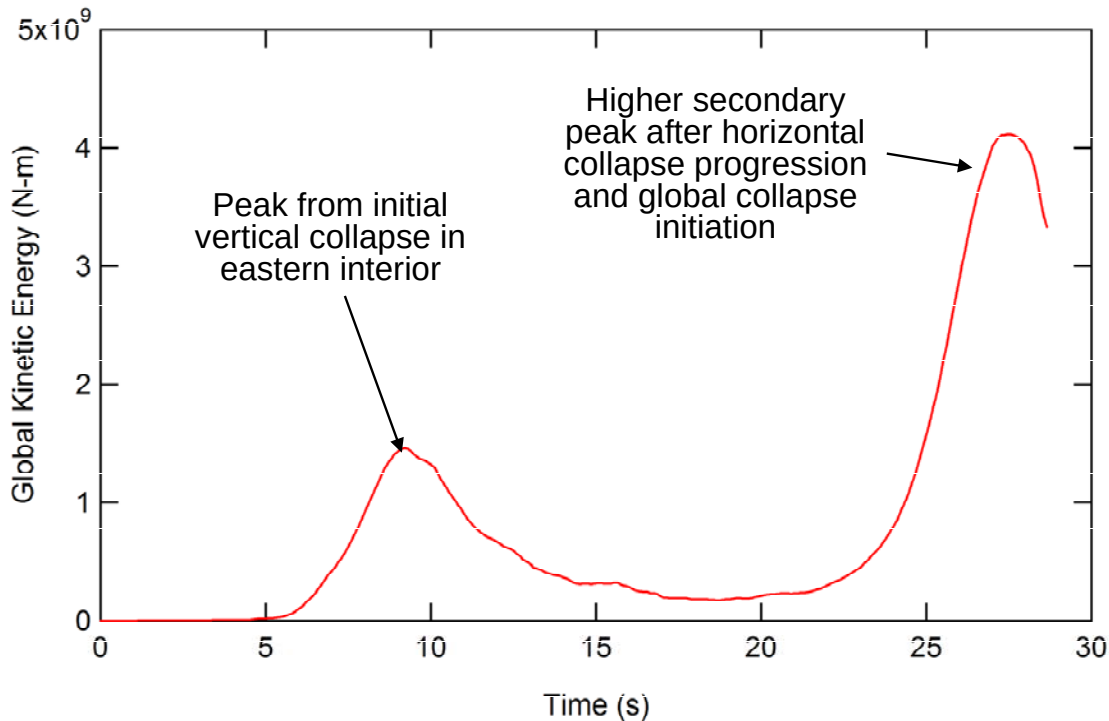


Figure 12–74. Global kinetic energy during the analysis without fire or debris impact damage.

12.5 COMPARISON OF SIMULATIONS WITH OBSERVABLES

12.5.1 Aspects Prior to the Global Collapse

Table 12–2 lists the major observed collapse events with corresponding times (collapse reference time frame) from the observable events and from the two global analyses, with and without debris impact damage, for Case B temperatures at 4.0 h. As shown in the table, the calculated time for the buckling of Columns 79, 80, and 81, the calculated and observed times for the start of the east penthouse downward movement due to the vertical collapse progression, and the calculated and observed times for the descent of the east penthouse below the roofline were quite similar, and independent of the debris impact damage.

The cascading failure of floors surrounding Column 79 and the buckling of Column 79 could not be ascertained from any videographic evidence. However, analysis of the east-west vibration of the building prior to collapse (Chapter 5 and Appendix C) revealed horizontal motion (± 2 in.) 6 s before the east penthouse began to move downward. The horizontal building motion started at nearly the same time as the cascading floor failures started in the LS-DYNA analysis (-6.5 s), which preceded the buckling failure