

The window breakage would have allowed the sound of a blast to propagate outward from the building. NLAWS, a validated acoustic wave propagation software program, was used to predict the propagation of the sound of the hypothetical blasts. The calculations showed that all the hypothetical blast scenarios and charge sizes would have broadcast significant sound levels from all of the building faces. For instance, if propagation were unobstructed by other buildings, the sound level emanating from the WTC 7 perimeter openings would have been approximately 130 dB to 140 dB at a distance of 1 km (0.6 mile) from WTC 7. This sound level is consistent with standing next to a jet plane engine and more than 10 times louder than being in front of the speakers at a rock concert. The sound from such a blast in an urban setting would have been reflected and channeled down streets with minimum attenuation. The hard building exteriors would have acted as nearly perfect reflectors, with little to no absorption. The sound would have been attenuated behind buildings, but this would also have generated multiple echoes. These echoes could have extended the time period over which the sound could have been detected and could possibly have had an additive effect if multiple in-phase reflections met. However, soundtracks from videos being recorded at the time of the collapse did not contain any sound as intense as would have accompanied such a blast (NIST NCSTAR 1-9, Chapter 5). Therefore, the Investigation Team concluded that there was no demolition-type blast that would have been intense enough to lead to the collapse of WTC 7 on September 11, 2001.

3.4 THE FOUR-STEP SIMULATION PROCESS

3.4.1 Technical Approach

To test the working hypothesis and to reconstruct the probable collapse sequence for WTC 7, the Investigation Team supplemented the information available from the photographic and videographic evidence, eyewitness accounts, and personal interviews with computer simulations. The analyses accounted for the debris-impact damage, the growth and spread of fires, the heating and thermal expansion and weakening of structural components, and the progression of local structural failures that led to the collapse of the building.

Figure 3–2 is a flow chart of the sequence and inter-dependencies of the analyses for the reconstruction of the WTC 7 collapse. Four models were used, as described in Sections 3.4.2 through 3.4.5.

Similar to the analyses conducted for the WTC towers, the analyses of WTC 7 continued to advance the current state of the art and tested the limits of computational capabilities. The unprecedented complexity and sophistication of these analyses required the use of various strategies for managing the computational demands while adequately capturing the essential physics of the problem. The uncertainties, the assumptions made, and the testing of these assumptions are documented in NIST NCSTAR 1-9. Beyond the assumptions that were considered in the collapse analysis of the WTC towers, four additional significant areas of uncertainty influenced the collapse analysis of WTC 7. These areas included fire growth and spread, debris impact damage due to the collapse of WTC 1, transitioning from the structural fire response to the collapse analysis, and the analysis progression from initiation to global collapse.