

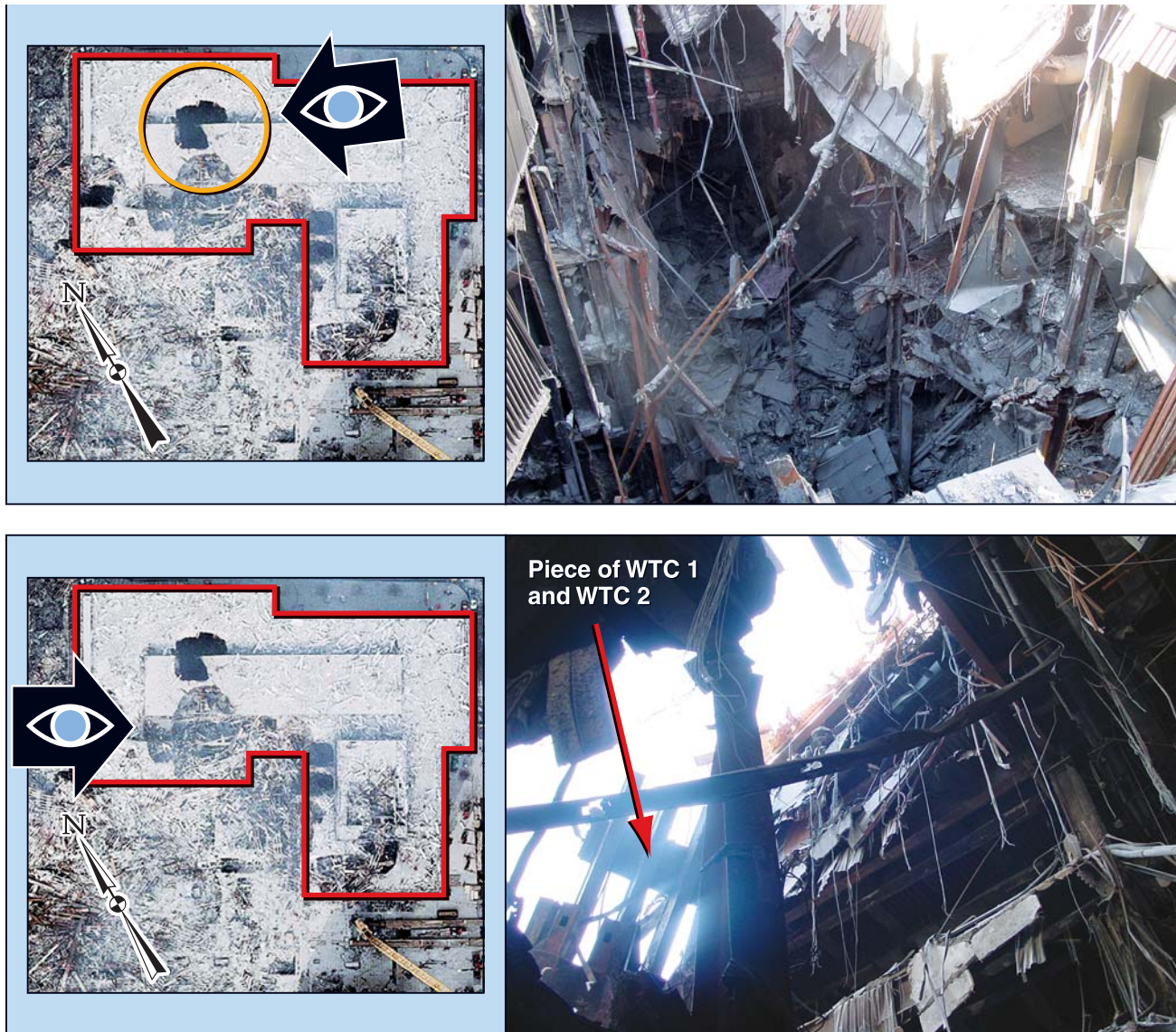


Figure 4-12 Impact damage to WTC 5 (continued).

As illustrated in Figure 4-17, there was local buckling of interior columns. This buckling was most likely due to a combination of fire-induced reductions in strength and a possible increase in stress due to restrained thermal expansion. A detailed explanation of these issues is presented in Appendix A, Section A.3.1.4.

4.3.2 WTC 5 - Local Collapse Mechanisms

Two areas in WTC 5 experienced local collapse under an intact portion of the roof. Although there was debris impact near this area, the symmetrical nature of the collapse strongly suggests that the failures were due to the uncontrolled fires. This is supported by the observation that the columns in this area remained straight and freestanding (see Figure 4-18). This local collapse appeared to have begun at the field connection where beams were connected to shop-fabricated beam stubs and column assemblies as illustrated in Figures 4-19, 4-20, and 4-21.

The structural collapse appeared to be due to a combination of excessive shear loads on bolted connections and unanticipated tensile forces resulting from catenary sagging of the beams. The existence of high shear loads, likely due to collapsing floor loads from above, was evident in many of the column-tree