

to burn as relatively low-intensity distributed flames. The preponderance of red in the north- and west-face maps in Figure 2–4 reflects this type of burning. In contrast, the fires burning on the east and south faces most often generated external flames and heavy smoke flows at nearby windows as indicated by the façade fire maps for these faces. Various explanations for the different fire behaviors were considered. The most plausible is based on the effects of the prevailing wind. On September 11, 2001, the wind was striking WTC 1 from the northwest and then flowing down the north and west faces. This wind created positive pressures at the windows on these faces that tended to resist gas flows out of the tower. On the east and south faces the effect of the wind was the opposite, creating low pressure areas at the windows that tended to draw gases out of the building. The net effect of these pressure forces was a tendency for gases to flow internally on a floor, if a pathway was available, from the west and north faces to the east and south faces. Such internal flows provide a plausible explanation for the observed differences.

This summary focused on the time variation of the fire distributions and intensities observed in WTC 1. NIST NCSTAR 1-5A also includes detailed time lines for window condition on the various floors and faces of WTC 1. Generally, as the fires spread into new areas, window glass in the immediate vicinity would break out. As a result, the number of open windows continuously increased. This, in turn, increased the amount of outside air available to support the fires burning inside. The total number of windows that were broken open by the aircraft impact and subsequent fireballs was estimated to be 236, with the majority located on the north face where the aircraft impact occurred. By the time of tower collapse this number had increased more than five-fold to 1,312, with roughly equal numbers on each face. This increase in the number of open windows provided an additional 12,470 ft² of ventilation area.

Summary of Observed Fire Behavior in WTC 1

There was a significant difference in the fire behavior on the different faces of the towers. Fires at most locations on the west and north faces of the towers burned without releasing large amounts of smoke or flames from nearby windows. In many cases the fires appeared to be distributed fires that burned at relatively low intensities. (Three major exceptions to this were: early north face fires to the east of the impact cavity on the 96th and 97th floors and the west face of the 97th floor, the fires that developed within rooms along the facades, and the fire that developed on the west face of the 104th floor following the collapse of WTC 2.) By contrast, the fires burning on the east and south faces often generated heavy amounts of smoke and external flaming at nearby windows. (Exceptions to this general behavior included fires that developed on the east face of the 92nd floor and on the east side of the south face on the 92nd and 94th floors.) The most plausible explanation for this difference is that the prevailing wind was striking WTC 1 from the northwest and then flowing down the north and west faces. This wind created positive pressures on the windows on these faces, pressures that tended to resist gas flows out of the tower. On the east and south faces the effect of the wind was the opposite, creating low pressure areas at the windows that tended to pull gases out of the building. The net effect of these pressure forces would be a tendency for gases to flow internally on a floor, if a pathway was available, from the west and north faces to the east and south faces. Such internal flows provide a possible explanation for the observed fire behavior.

The exceptions noted above for the north and east faces provided support for this explanation. When the early fires developed on the north and west faces, most windows on the 96th and 97th floors still had glass in place on the east and south faces. As a result, internal pathways connecting the openings on the high pressure and low pressure faces did not exist. The fire burning on the west face of the 97th floor abruptly