

CONCRETE COLUMNS

DAT: ~30 MIN¹

DECAY INDICATORS

- Progressive or deep spalling
- Exposed/heated reinforcement
- Widening structural cracks
- Bowing or leaning
- Increasing lateral displacement
- Crushing at connections or bearing areas
- Damaged or deformed reinforcement
- Movement of supported beams, girders, or slabs

SINGLE MEMBER FAILURE: ~40 MIN¹ — Lower-end demonstrated loaded-column fire resistance; many tests substantially longer.

STRUCTURAL ASSEMBLY FAILURE: RANGE TOO LARGE / NO SINGLE FAILURE TIME¹ — Column failure can redistribute major loads into the surrounding structure.

IDENTIFICATION AND USE

Concrete columns are vertical structural members that transfer concentrated floor, roof, and framing loads downward through the building. Reinforcement is commonly embedded within the concrete but may not be apparent during fireground operations.



WHAT THE FIRE RESEARCH SHOWS

Loaded fire testing showed an extremely broad range of endurance.¹ A full-scale 8 × 8 in. (200 × 200 mm) reinforced-concrete column reached its load-bearing fire-resistance limit at about 40 minutes, providing a lower-end experimental anchor. Many other loaded columns have endured substantially longer.

Performance depends strongly on column size, applied load, slenderness, eccentricity, concrete cover, reinforcement, aggregate, and spalling. High-strength concrete can also be more susceptible to explosive spalling.

THE WAY IT FAILS UNDER FIRE

Fire progressively heats and weakens the concrete and embedded reinforcement. Spalling removes concrete and can expose reinforcement to more rapid heating.

As strength and stiffness decrease, the column may bow, develop increasing eccentricity, and become unstable. Because a primary column may support multiple floors or large areas of structure, localized column failure can affect structural areas well beyond the damaged member.