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By VINCENT DUNN, DEPUTY CHIEF, FDNY. (RET)



## **FRONT WALL COLLAPSE DANGER**

The front wall of a building is defined by Webster's dictionary as the façade of a building. The front wall of a burning building has several deadly fixtures that collapse and kill firefighters. A parapet, marquee, canopy and cornice are all parts of a building's front wall that collapse during a fire. Incident commanders must size-up the front wall of a burning building and identify these dangerous construction features during a fire. Incident commanders must know the collapse warning signs of a parapet, marquee, canopy or cornice. When they see any of the above construction dangers on a front wall of a burning building they must take defensive actions.

### **FRONT WALL COLLAPSE DANGERS**

First, let's define some construction terms:

A parapet is a continuation of an exterior wall above the roof level. The portion of a front wall rising above a roof is the "parapet."

A marquee is a large metal structure attached over the entrance to a theatre or store. A marquee extends from the front wall out to the street and is used to display signs about the show or the store.

A canopy is a cloth, wood or metal covering over a building entrance designed to protect people from the weather.

A cornice is a horizontal ornamental construction along the entire front wall of a building, usually near the top.

Fire officers responding to a fire in a building, which has any one of these structural attachments as part of its facade, must consider it a collapse danger. Just the presence of any one of these decorative structures on a burning building wall at the front, side or rear must be considered a collapse warning sign. During the firefighting operation a parapet, marquee, canopy or cornice must be monitored for failure. A parapet wall supported by a twisting steel beam could collapse suddenly like a giant stone wave. A marquee filling up with water from hose streams could collapse and pull the parapet wall on each side down with it. Or, a canopy with firefighters or equipment on its top could collapse and pull a supporting brick wall down with it ' crushing firefighters below. And a cornice weakened by fire could suddenly collapse at one end; swing down across the front of the building killing firefighters at the other end.

A canopy collapse caused one of the greatest tragedies in the history of the fire service. It occurred in a burning meat packing plant in Chicago in 1910. During the fire, a brick wall and a canopy attached to it collapsed. Twenty-one Chicago firefighters were crushed to death beneath the crumpled metal canopy and bricks. A similar collapse occurred in New York City. Six firefighters were killed when the weight of a metal canopy pulled a brick wall down on top of it. The falling bricks landing on top of the corrugated metal canopy caused it to collapse on firefighters operating hose-lines below the shed.

A marquee collapse caused another tragedy in New York City. A heavy marquee attached to a parapet wall collapsed during a fire in a furniture store. The falling marquee pulled the brick wall on each side down too. Again six firefighters died.

A parapet wall collapsed during a fire in Altoona, Pennsylvania. The front wall of a burning auto electric store collapsed on a firefighter as he exited the building after searching for a victim. Another parapet wall collapse in Mount Kisko, New York, seriously injured a firefighter

A cornice collapse in Los Angeles County killed a firefighter a 160-foot long cornice collapsed suddenly during a fire in a row of stores. The cornice collapse started at one end of the storefront and killed the firefighter operating a hose-line at the other end.

### **COLLAPSE CAUSES:**

Parapet walls are unstable because they are free standing. A freestanding wall is considered by engineers to be the least stable of three basic types of walls (free standing, nonbearing, and bearing wall) because it has fewer connections to a structure. The more connections a wall has to the structure it is part of, the more stable the wall.

A parapet wall built over a one or two story commercial building with large display windows beneath it is a collapse prone structure because the parapet walls are often supported by steel beams. A steel beam spans the large windows and supports the parapet wall above. A small shock during a fire can topple a parapet down on to a sidewalk. An explosion, the impact of a master stream or an aerial ladder can also cause a parapet wall collapse. If during a fire the steel beam designed to support a parapet is heated to 1100°F and starts to expand, warp, twist or sag, it can collapse the parapet wall off its foundation.

A fire in a row of stores caused a steel beam to expand causing a bulge in the parapet wall. During the fire the bulging section collapsed, pulling the entire 100-foot wall on each side down with it as it collapsed.

Ironically, a parapet wall often supports a marquee, canopy or cornice. This is an unstable structure supporting an unstable structure. A marquee beam goes through a parapet wall and is connected to a roof or floor beams behind the facade. In addition, the marquee may also be connected to the parapet by steel cables.

A marquee is cantilever beam supported at only one end. This is considered by engineers to be the least stable of the three basic beam designs (a cantilever beam, a simple support beam and a continuous support beam). A cantilever beam is supported at one end. A simple support beam is supported at both ends. A continuous support beam is supported at both ends and the center.

If a marquee collapses during a fire, it can pull the facade wall down with it. For example, if the beams behind the facade which support the marquee are destroyed by fire, the marquee can suddenly collapse downward, pulling the wall it passes through, outward. Another cause of marquee collapse is overloading due to water build up inside the marquee. A marquee is like a swimming pool hanging off the front of a building because it is hollow. If the drains from the hollow portion of the marquee are clogged during a fire, it will collapse due to the excess weight. And, if the marquee falls, it can pull the front wall down with it.

A canopy is more of a collapse danger than a marquee. A canopy is a cantilever beam, like a marquee; but it is lightweight and is constructed of small pieces of wood or metal held together by bolts, cables and small pieces of framework. Like a truss, a canopy is only as strong as its weakest connection. A marquee is one large continuous beam supported only at one end; a canopy is structural composition of non-continuous beams supported at one end. If a bolt, cable or framework connector of this non-continuous beam fails, it can trigger a complete canopy collapse. A structure exposed to fire usually fails at one of its connections. A canopy, which has many points of connection, has a greater chance of failure than a marquee, which has few connections.

Another reason a canopy can collapse is because it is combustible. Some canopies have a wooden framework of rafters supporting the shed roof. The most dangerous type of canopy is a metal or wood shed suspended over a truck loading area. It is designed to protect workers and products from the weather. These corrugated tin or wood canopies found on buildings in the oldest section of town are covered with tarpaper.

Old skylights, originally designed to provide light on the platform below, are sometimes tarred over. They look like scuttle covers on top of the canopy, but collapse when stepped on. Adding to the collapse danger of a canopy is a system of tracks and rails suspended from the underside. Heavy products unloaded from trucks or railroad cars are attached to the rail system and pushed inside the building. The weight of the rail system heightens the canopy collapse danger. Firefighters must realize a canopy is not a porch. It may look like a porch, but it is not. A canopy is supported on one end only. A porch with columns is supported at both ends. Firefighters should not stretch hose streams on top of a canopy roof or place ladders on top of a canopy roof. Twenty-one Chicago firefighters and six New York City firefighters died when a canopy collapsed. When the canopy collapsed, it pulled the brick wall down with it. The

firefighters killed were outside the burning building, but operating hose-lines beneath the canopy. The lesson learned at these tragedies is that the area beneath a canopy should be considered inside the burning building. When there is a danger of collapse due to a large body of fire, withdraw not only firefighters from the burning building but from beneath the canopy as well. The area beneath a canopy should be considered inside the collapse danger zone.

A cornice is a decorative horizontal overhang, projecting outward along the top wall of a building. If a parapet wall is defined as a portion of an exterior wall extending above the roof, a cornice can be defined as a portion of the roof extending out beyond an exterior wall. A cornice is also a cantilever structure, like a marquee and canopy, but there is one important difference. A cornice burns and spreads fire. A cornice may be constructed of wood or combustible plastic and it may have a wood framework inside, and/or wood shingles outside. A fire officer should also be concerned about horizontal fire spread from one end of a building to the other via a cornice.

Flames blowing out of a window below a cornice will spread to the cornice. Flames will then spread along the underside of the cornice or inside its framework, possibly to an adjoining building. After flames destroy a cornice, it can collapse off the facade. Also, when a cornice has been weakened by fire, it can collapse due to a sudden impact like being struck by a powerful master stream. If a cornice collapses suddenly it will crash down like a wave of death and destruction. Firefighters operating at one end of a building can be crushed under a falling cornice that starts to collapse at the other end.

## **SAFETY STRATEGIES**

There are four strategies an incident commander can use to safeguard firefighters when the front wall of a burning building appears about to collapse during a fire:

- **Use the reach of the hose stream.** Firefighter should use the 50 foot reach of a hose stream to withdraw a safe distance away from a dangerous parapet, marquee canopy or cornice that appears in danger of collapse.
- **A collapse zone** can be established by the incident commander and all firefighter can be withdrawn out of the collapse zone. A collapse zone is defined as withdrawing firefighters away from a front wall a distance equal to the height of the wall in danger of collapse.

- **Flank the front wall.** Firefighters operating hose streams can be positioned in front of adjoining buildings and their hose streams can be directed on the burning building from a flanking position. The stream may not be as effective being directed from an angle; however the firefighters will be away from the front of the building wall in danger of collapsing.
- **Corner safe areas** can be established around the burning building. When we look at the fireground around a burning building standing by itself from a birds-eye view we see there are four areas in which to park apparatus and operate master streams -the four corner safe areas. If the front wall and all the other walls of a burning building collapse outward simultaneously (which is very unlikely) there would be four corner areas on the fireground where fewer bricks would land. These are the so-called four corner areas. Probability of survival is greatest in the four corner safe areas. When there is danger of collapse a safety strategy used by an incident commander is to position aerial streams, portable deluge nozzles, and deck guns on pumpers inside the four corner safe areas.

### **Questions for Newsletter:**

**1. Which one is not front wall danger?**

- A. Parapet wall**
- B. Cornice**
- C. Marquee**
- D. Canopy**
- E. Roof mahine**

**Answer** \_\_\_\_\_

**2. Hhorizontal ornamental construction along the entire front wall of a building, usually near the top, is the definition of?**

- A. a Canopy**
- B. A marquee**
- C. A cornice**
- D. A parapet**

**Answer** \_\_\_\_\_

**3. Which one is not a safety action an incident commander can order when there is a danger of front wall collapse?**

- A. Stand near a doorway**
- B. Set up a collapse zone**
- C. Flank the dangerous wall**
- D. Operate in corner safe areas**

**Answer \_\_\_\_\_**

**4. A steel beam will start to twist warp sag and fail at what temperature.**

- A. 0900 Deg. F**
- B. 1100 Deg F**
- C. 500 Deg. F**
- D. 300 Deg. F**

**Answer \_\_\_\_\_**

**5. Which one of the following wall is least stable?**

- A. Bearing Wall**
- B. Nonbearing Wall**
- C. Nonbearing wall**
- D. Overbearing wall**

**Answer \_\_\_\_\_**

**Answers: 1. E; 2. C; 3. A; 4. B; 5. D**