Construction Concerns: Structural Steel Lintels

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For www.fireengineering.com Photos by author.

More than 100 years ago—before structural steel was common in lintels above windows and doors—windows were narrow by today’s standards; the masonry was at the top of each opening supported by either a brick arch or a wood lintel. Photo 1 shows a building with the tops of its window openings supported by brick arches.
Photo 2 shows a window from a building dating to 1875 with a wood lintel that was eventually bricked up inside the wood window frame because it was directly below a fire escape.
Photo 3 shows a building of Type III (ordinary) construction, in which three windows are supported by a common brick arch.

For the past 100 years, structural steel has been in common use for lintels above windows and doors. Structural steel allows the use of wider windows, and door and window openings are supported by a common lintel.

Photo 4 shows the second-floor windows from a large railroad station that was built in the early 1900s. It shows the long spans of structural steel that were used to support the masonry wall above the windows. To the right of the column, between the two windows, the brick masonry is still in place, concealing the steel. To the left of the column, the face brick has been removed for repairs, exposing the structural steel with its riveted joints.
Photo 5 is a closer view of the same structural elements. Note that the steel lintel supports brick masonry above the windows and a separate beam of structural steel is located several courses above the lintel to support the steel roof framing. Also note the bricks that are supported by the bottom flange of the steel beams and which are used to fill in the space between the flanges of the beams.
Photo 6 shows another view of this structure between two other windows, with some of the structural steel still concealed in masonry.
Photo 7 shows a modern structure with concrete masonry units (CMU) supporting the ends of a structural steel lintel, which in turn supports the CMU masonry above it. Thinner CMU sections of the same dimensions as the CMU used to build the wall are used to fill in between the flanges of the structural steel, which will be almost completely concealed when the building is complete.
In both the older and modern masonry, the brick and CMU provide heat resistance to the web and the upper flange of the beam. The bottom flange of the beam will be exposed to heat in a structure fire. This heated bottom flange can carry heat into the rest of the beam and cause expansion enough that the beam will buckle if the ends are restrained, which will drop all of the masonry in the wall above into the street. This type of structural collapse has killed many firefighters over the years and has been the subject of several magazine articles and chapters in fire service text books. See *Collapse of Burning Buildings*, second edition, by Vincent Dunn, Chapter 5 “Collapse Dangers of Parapet Walls”; available from Fire Engineering Books at [http://www.pennwellbooks.com/fire-rescue/technical-rescue/collapse-of-burning-buildings-a-guide-to-fireground-safety-second-edition](http://www.pennwellbooks.com/fire-rescue/technical-rescue/collapse-of-burning-buildings-a-guide-to-fireground-safety-second-edition) (ISBN10 1-59370-233-7)
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