Steel Framing Alliance™
Steel. The Better Builder.
VOL. 1 ISSUE 3

FIGHTING FIRE WITH STEEL
FIRE RESISTANCE 101

Today's consumer is placing greater value on the quality, longevity, and safety of their new home. Key issues in the homeowner's mind include increased safety in fire and severe weather, minimizing termite damage, and the increased use of recycled materials. Some of steel's most apparent benefits touch on each of these key issues. Fire safety, among them, is top-of-mind for many homeowners who must rebuild due to common house fires, resulting in thousands of deaths and injuries each year.

A Look at the Statistics

According to the recently published National Fire Protection Association (NFPA) Survey, there were 401,000 house fires in 2002, resulting in 2,670 deaths, 14,050 injuries, and more than $6 billion in property loss. That equates with a house fire every 79 seconds. On average, structural members or framing, rank third as the first-ignited material in home fires. And fuel contributed by wood framing can propagate fires that start elsewhere in the structure.

Steel does not contribute fuel to a fire. A fire that does start in a steel-framed home is less likely to spread from the area of origin than one starting in a wood-framed home. All of this tragic loss, due to fires that ignite in framing, as well as those in which the wood framing contributes to the fire's spread, can be overcome by the use of steel framing.

A Case in Point

While the properties of steel suggest that damage due to fire is significantly reduced when compared with traditionally built wood frame homes, one case study proves the point. A house fire occurred on July 2, 1996 in the Summerset at Brentwood development in Northern California, on a steel-framed single family home. The homeowners were out of the house when the fire began in the kitchen and were unharmed, just as their steel frame suffered little to no structural damage. "Although the flames caused $75,000 in damage to the house, the destruction could have been much worse if the frame had been built of wood," said Gary Johnson, the builder.

House fires can spread extremely quickly, leaving inhabitants a short time to escape. If the framing members are steel, however, the fire is more easily contained to the initial start location, and spreads at a slower pace, allowing inhabitants more time to escape.

To confirm this with statistical evidence, thorough metallurgical analysis was performed on the framing members of the Brentwood home, comparing both unaffected and charred studs. Information that relates to the long-term structural integrity of the home was of key interest, as well as susceptibility to corrosion.

Results showed all mechanical properties, even from charred samples, appeared consistent. Michael Simko, Research Project Engineer who conducted the testing, reported "…the yield strength, ultimate tensile strength, and total elongation values appear to be adequate for residential framing."

For comparison purposes, most specifications call for greater than 33ksi yield strength for structural studs. "The fire," Simko continued, "seems to have had little effect on the mechanical properties of these members." Further testing produced evidence which indicated the "retention of mechanical strength in spite of the fire and furthermore suggests that the zinc coating remained on the surface," said Simko. "In some places, the zinc coating alloyed with the substrate to create a lightly iron-rich 'galvannealed' coating."

Charred steel studs from 1996 Brentwood, CA home fire maintained structural integrity.

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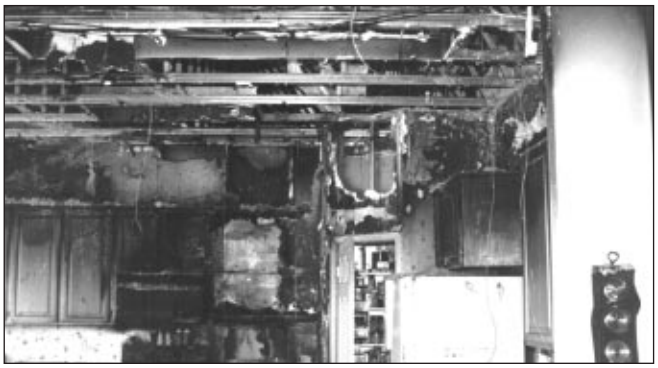

Kitchen reconstruction required no steel frame replacement.

Fire Resistance Ratings

Cold formed steel has been widely used in commercial interior and curtain wall applications, due in part to most building codes' requirement of the use of fire-resistance materials. Thus, the construction industry can draw strong inferences from its widespread commercial use when considering fire implications in residential steel applications.

Building codes frequently require steel framed assemblies to have a fire-resistance rating that is based on fire tests conducted in accordance with a recognized standard test such as ASTM, the American Society for Testing and Materials. The fire rating of an assembly is a measurement indicating how long the assembly will resist the spread of fire while maintaining structural integrity. Fire resistance ratings are expressed by the number of hours that a wall assembly can maintain its integrity while containing the fire, smoke, and temperature of a working fire.

With life safety, and specifically fire protection, a primary concern for US building codes, there are significant requirements regulating the use of fire rated assemblies through the installation of fire-stopping (or fire blocking), draft-stopping and fire suppression systems. Gypsum wallboard and its derivatives provide the necessary fire protection in floors and walls, such that one or two layers of fire-resistant boards will provide the 1- or 2-hour fire protection. Major model building codes outline the minimum fire rating requirements of steel framed assemblies.

The American Iron and Steel Institute (AISI) tested and reported fire resistance ratings of load bearing steel stud walls with gypsum wallboard protection (with or without cavity insulation) in the early 1980s. The study was conducted to develop an analytical method making it possible to predict the structural behavior of cold-formed steel framing in load-bearing walls under the conditions in the ASTM E119 Standard Fire Test. As a result, fire-resistant ratings, construction and material details are provided in UL Fire Resistance Directory as Design U425.

Insurance Ratings

While residential steel framing data is not readily available in sufficient quantity over an established timeline to develop adequate trend analysis and insurance risk calculations, there is case-by-case evidence that insurance companies are sitting up and taking notice of the significantly reduced fire risk when steel is used. One in particular was highlighted by a structural engineer in California late 2003; a large multi-family residential project built with light gauge steel framing allowed the builder to save approximately $400,000 in builders risk insurance.

While the statistics are compiled over time, the opportunity for insurance discounts continues to grow across the country. Affecting both reductions in homeowner and builders risk premiums, insurance underwriters and brokers are beginning to offer programs in Texas, Florida, Indiana and other areas, where high profile homes are being built with light gauge steel framing systems. The Steel Framing Alliance compiles this information and posts applicable programs on its web site, www.steelframingalliance.com.

To learn more, visit any of the following sites:
Steel Framing Alliance, **www.steelframingalliance.com**
National Fire Protection Association, **www.nfpa.org**
American Iron and Steel Institute, **www.steel.org**
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