LightweightSteelFraming

Technical BULLETIN

Report on:

Fire Performance

Volume 1, Number 1

On July 2, 1996, a gas stove caused a fire in the kitchen of a steel framed home in Sommerset at Brentwood, CA. The home, built by Innovative Steel Systems, is one in a 2000 home development.

The fire caused $75,000 in damages to the interior and personal property. In this steel framed home, the flames were contained to the kitchen with smoke damage elsewhere and no structural failure of the steel roof trusses or wall frames occurred. If this home was of typical combustible construction there would have been additional costs incurred to replace charred members and to chemically treat those charred members that were not replaced to seal in smoky odours.

The firefighters were impressed with the fact that the fire was contained to the hot spot in the kitchen. Developer Sheryl Palmer, V.P. of Marketing and Sales for Sommerset at Brentwood, was not surprised. Steel framing does not add fuel to a fire. This allowed sufficient time for the fuel source, in this case kitchen cabinetry, to burn itself out.

Photo 1: Courtesy of USS Posco

According to firefighters the fire reached temperatures of 650 to 760°C (1200 - 1400°F) and yet no structural failure of the steel frame occurred. The firemen commented that if the structure was of traditional wood frame, the damages would have been more extensive.

An analysis was performed on the steel truss cord and wall studs in the area most affected by the fire. Physical testing showed that the mechanical properties of the members still met the specifications for structural steel studs. The zinc coating on the steel remained intact and in some places there was evidence of alloying with the steel substrate to produce galvanneal, a product commonly used in manufacturing automotive body panels. As a result of this analysis, none of the framing members needed to be replaced.

In combustible construction replacement of framing members depends on the amount of charring in that member. This is generally performed by surface inspection and can often be subjective, thereby compromising the structural integrity of the building.

In October 1996, in the western community of Tucson, AZ, a fire ripped through a studio/garage that was being built with lightgauge steel framing and straw bales. A fire began when a worker's torch ignited the straw bales in one corner of the structure. One can only imagine how quickly the fire spread fuelled by the unfinished straw bales and plywood sheathing.

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Straw bale construction is understood to be fire resistant because compressed straw bales in finished walls leave little room for oxygen, which is needed for a fire. Owner/Builder Ron Carswell, has successfully built several similar structures which uses lightgauge steel for posts and beams to carry the loads and straw bales to infill the space between the frames. Ron is an avid proponent of straw bale construction.

Since this building was not yet finished the fire spread quickly. When Tucson fire response teams arrived, the structure was fully engulfed and a decision was made to let the fire burn itself out. The fire reached temperatures of 650°C (1200°F) which was hot enough to severely crack the concrete floor slab. When the smoke cleared the steel framing was still standing. Doug Emans, assistant fire chief at the scene was surprised. He said "a similar wood structure would have collapsed". Another firefighter commented that wood would have been "toast". In fact 2" x 6" lumber used to frame around some of the openings was just that. With the framing still standing it greatly reduced the fireman's task of checking the debris to ensure all hot embers were out.

The insurance claims adjuster was also impressed. In all of his experiences of inspecting the aftermath of fires he couldn't believe the roof trusses and walls were still standing after all the sheathing had burned off.

The performance of any light framing material in a fire will depend on the intensity of the fire. What one can count on in the case of steel framing, is that this material will not add fuel to a fire. In principle this would prevent propagation of fires. Lightgauge steel framing members that have been exposed to extreme conditions and that have failed are easily identifiable and hence replaced, which is not the case with combustible framing members. Any smoke adhering to steel framing members is washed off with a mild detergent while chemical treatment is required to seal the odour in combustible members.

In the Brentwood and Tucson homes the containment of the fire can be attributed to the non-combustible steel framing used in building the home. Not having to replace the framing members contributes to lower damage costs, which should help the insurance industry to evaluate the possibility of lower premiums for steel framed homes that are fully finished or under construction.

For More Information from CSSBI

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Photo 2: "Steel framing still standing after the fire." Courtesy of American Studco