

INTRODUCTION TO HEAVY TIMBER FIRE TEST FILM

By Robert D. McPherson

Wood has remained a primary construction material for hundreds of years despite ever increasing competition. The reason is that no competitive material has all the advantages of wood. It is available in vast renewable quantities and is extremely competitive in cost. It has a high resilience, or ability to absorb shock. This desirable quality was well illustrated in the recent Alaskan earthquake. Wood frame structures retained their structural integrity while buildings of other materials were collapsing around them.

It has excellent insulating qualities. One inch of wood is equal in insulating value to 6" of brick and up to 15" of concrete. Aluminum conducts heat (or cold) approximately 1700 times faster than wood and steel approximately 400 times as fast.

It can be produced in many sizes and shapes, from delicate finish work to large glue-laminated arches and beams. And what is more--it can be easily worked with simple tools.

Left in its natural state it offers infinite variety of grain and texture. It can be stained with very light stains or heavy bodied stains, and painted, it presents a smooth, attractive surface.

It offers a very high strength-to-weight ratio, and contrary to some opinions, it will last indefinitely when properly used. Wood buildings up to 1200 years old are still being used.

Wood perhaps encounters its greatest criticism as a construction material because it is combustible--it will burn. Most of you have heard people say, "We should build schools out of 'fireproof' materials so our children will be safe", or "Let's build the new courthouse out of 'permanent-fireproof' materials," indicating that wood should not be used. We occasionally encounter legislative attempts to not only restrict, but in cases, to prohibit construction with combustible materials.

In the eyes of the layman, any building material that is called "Non-Combustible" may be regarded as more fire-safe than wood. Yes, some people even consider such a building to be "fire-proof". However, actual fire experience does not support those mistaken opinions.

Building fires nearly always originate from the contents of a building since no building material is subject to spontaneous combustion or even easy ignition. And the danger to life occurs long before there is any danger to the structure itself. Thus safety of life in a building fire is more a matter of design than construction materials. In other words, get the people out before they are endangered by the smoke and fumes from the burning contents. This should be accomplished by adequate and well located exits, fire-detection and extinguishing devices and protection of hazardous areas.

How many times have you read about a fire involving loss of life in an "old wooden building?" Chances are the loss of life occurred not because the building was "wooden" but was because the building was old, and designed when little was known about designing buildings for fire-safety. Many of these old buildings, both wood and other materials, have open stairways, poor egress, worn out heating and lighting systems and no alarm systems. They would be fire-traps whether of wood or other materials. It just so happens that most old buildings were built with wood, thus it is logical that most fires in these old buildings would occur in "wooden buildings."

The safety of the structure itself, as opposed to life-safety, is more dependent on early detection of the fire, adequate fire-fighting facilities, and the performance of the building material when exposed to fire.

The performance of wood in fires is greatly misunderstood, thus resulting in a tendency of the layman to insist on so-called fire-proof construction. Truthfully, all building materials are affected by fire. Some lose section as the char progresses, some soften and lose strength and others crumble when exposed to high temperatures. So non-combustible construction does not mean fire-proof construction. In fact, the largest fire loss in insurance annals occurred when the General Motors hydraulic plant burned at Livonia, Michigan in 1953. This was a non-combustible building with non-combustible machinery that used non-combustible materials to produce a non-combustible product--yet it was completely destroyed by fire.

In order to provide building designers and owners with reliable information on the comparative behavior of unprotected wood and steel, two fire tests have been conducted at the Southwest Research Institute in San Antonio, Texas. In the first test conducted in 1960, steel joists and sawn wood joists designed for the same span and loading were exposed to the same fire conditions. At temperatures averaging 1360° the steel joists collapsed in 13 minutes, while the wood joists, though they burned, deflected only 1/2" and when the steel joists collapsed, there was still 80% of the wood joist section left, undamaged, and carrying the design load.

The second test conducted by Southwest Research Institute in 1961 compared a 16" steel wide-flange beam with a 21" glulam beam designed for the same span and load. I have a film of this test here for you today.

Before showing the film I would like to stress that these tests were not made to discredit a competitive building material, but to demonstrate emphatically the fire resistance of wood construction when exposed to the high temperatures which commonly occur in building fires.