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Education Saves Lives: The Fire Performance of Wood Trusses — Part 5 by Molly E. Butz

The Carbeck Structural Components Institute uses real-time fire testing to dispel classic fire service myths about the use of wood trusses in building applications.

The progression of truss construction throughout history has brought with it a fair amount of bad feelings and negative press. Two of the most well-known fire service educators, Retired Fire Chief Vincent Dunn and Frank Brannigan, SFPE, are no exception to the rule. Both Dunn and Brannigan have continued to educate using statements like, "Don't trust a truss," "disastrous to firefighters" and "the truss has finally been identified as the killer it is." However, sections 5, 6 and 7 of the Carbeck Structural Components Institute's (CSCI) educational program demonstrate the facts about the fire performance of wood trusses.

FIGURE 1

Section 5 of The Fire Performance of Wood Trusses begins by reviewing some of the commentary most frequently used by Dunn and Brannigan in their training sessions and literature. Their thoughts can be distilled into a handful of concepts that many people in the fire protection industry believe to be true about trusses. To begin to wrap facts around truss fire performance concepts, a short video demonstrates the performance of a two truss splice plates connecting the bottom chord 2x4s in a small truss assembly and subjected to the American Society of Testing & Materials (ASTM) E119 fire conditions. ASTM E119 is a standardized fire time-temperature test requiring the assembly to reach 1000°F within five minutes. After more than ten minutes of burn time and significant charring of the wood under the truss plate is the plate forced to exit the wood due to the load placed on the assembly.

FIGURE 2

Three other fires—to a residential garage, a dental office and a church—provide additional evidence of complete truss assemblies that were severely charred and still continued to carry their dead loads as well as added loads from debris and people. In the garage fire, even though the trusses remained mostly intact, the aluminum siding melted, which means the fire must have reached temperatures over 1200°F. The fire in the dental office burned for more than 75 minutes and the floor trusses were virtually unharmed. Many of the structure's roof trusses, although unbraced after the sheathing burned away, still remained vertical and carrying a load on their bottom chords.

The church fire is the most amazing of the examples given in Section 5. In an effort to prevent the spread of a fire caused by a canister light in the ceiling, firefighters cut out the smoldering chord and web members of the trusses. As seen in Figure 1, the firefighters then stood on the cut trusses, using them as their only form of support. Not only did these trusses support their own dead load, but they also continued supporting the live load of the roof as well as the fire service personnel.

On the more technical side, Section 6 details specific fire testing and gives an introduction to the ASTM E 119 fire testing process. Also examined is the relative performance of different materials when exposed to fire, including steel and aluminum and a look at the specific reaction of wood when exposed to fire.

A detailed description of the ASTM E119 fire testing process is given later in this section. The purpose of ASTM testing is to assign a one, two, three or four-hour fire-resistive rating to any given construction assembly based on a standardized protocol. The assessment is based on the following failure criteria: heat transmission, flame penetration and structural collapse. After E119 testing, the wood and metal plate assemblies are analyzed for damage and structural integrity.

Fire testing conducted in the fall of 2000 by the Phoenix Fire Department and the National Institute of Standards and Technology (NIST) offers a most realistic look at the performance of wood trusses under the siege of fire. Section 7 of the CSCI educational program includes video clips of this testing which was performed on four identical 432 square foot "houses" (see Figure 2). The video selections demonstrate two burns, each just over 15 minutes long. This testing established that the wood trusses out-performed the sheathing (which burned and fell through the roof) and that even under the most rigorous testing conditions, the trusses remained standing with the metal plates still embedded.

These sections of the CSCI educational program provide solid, tested facts about the fire performance of wood trusses, not only from the perspective of a component manufacturer, but also incorporating actual testing by the fire service. These sections show that buildings using trusses do not always have roof or floor areas that collapse, that truss plates don't loosen and "pop off" when a fire starts and that trusses perform in a similar manner to other structural elements during the siege of fire.

Yes, it is true that any burning building is the firefighter's enemy and circumstances on the fire

ground can lead to death. However, the loss of one firefighter is one too many. Education and training are the keys to dispelling the myths about wood truss construction and enhancing life protection at the scene of a fire.

Captain Esch's Two Hats

The Iowa Truss Manufacturers Association (ITMA) is actively involved in using Carbeck's The Fire Performance of Wood Trusses educational CD for firefighter training. Therefore, it seemed like a natural step to speak with Rick Parrino, ITMA Chapter President about his experiences with the program. That conversation led to an interesting gentleman named Alan (Al) Esch. Al is the Maintenance Supervisor at Lumber Specialties, Ltd., a Roof & Floor Truss Manufacturer in Dyersville, IA. Needless to say, he favors component construction. However, the interesting twist to Alan's story is his affiliation with the local fire service; he's not just a friend, he's their Captain.

As a Firefighter I, Firefighter II and Firefighter Service Instructor I certified volunteer firefighter, Captain Esch has a passion for training. Lumber Specialties supports Al's involvement in the fire service, especially in his educational efforts to reach fire service personnel. After viewing a copy of the Carbeck educational program, The Fire Performance of Wood Trusses, Captain Esch took it upon himself to spread the word. He began using the Carbeck CD with what could be his harshest critics, his own department in Dyersville. Captain Esch was pleased with the results of his initial training experience and forged ahead.

After speaking with an Assistant Fire Chief in Dubuque, IA, Captain Esch led a three-day, three-shift workshop in which more than 80 firefighters viewed the Carbeck program. Many of the firefighters were impressed, commenting on the positive aspects of the presentation. "It's nice to see that they're [trusses] not as bad as they're made out to be," one attendee noted. And overall, Captain Esch felt that the trainees were very accepting of the information they had received. It could be difficult for Al because he wears two, often conflicting, hats—one working for a component manufacturer and one as the Fire Captain. But what he has found is that these two hats are intertwined and his responsibilities at work and as a trainer are invaluable to our industry.

"We're not going to see the heavy timber construction of 100 or 200 years ago, truss construction is continuing to grow," he remarked. "We've been drilled so many times about how dangerous trusses can be, but the reality is, it doesn't matter if a building is made with trusses or pre-cast concrete, fire is fire and any situation can be dangerous. It's up to the Incident Commander to make a decision based on the facts at the fire ground when he sends someone into a burning building."

When those decisions need to be made, education and training can make the difference between life and death on the fire ground.

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