

### Frequently Asked Questions

#### Fire Damaged Trusses by Rachel Smith

How much fire damage is too much? That's a good question with no definitive answer. As the Wood Engineering and Construction Handbook states, "The exposure of wood to elevated temperatures results in a loss of unit strength. With short-time exposure there may be no lasting effect, but long-time exposure causes a permanent loss in unit strength, the degree of loss being dependent on both temperature and duration of exposure." The uncertainty lies in the fact that the temperature and duration of exposure to the fire are unknown variables.

According to the National Design Specification for Wood Construction, "Prolonged heating to temperatures above 150°F can cause permanent loss of strength." Wood begins to char at 480°F and burns at 550°F to 600°F, so charred wood by definition has seen temperatures in excess of 150°F and uncharred wood may also have seen temperatures in excess of 150°F although it may not meet the definition of "prolonged." That is why some engineers are hesitant to declare that trusses are acceptable after fire exposure even if they only exhibit smoke damage.

Some research suggests that the plate protects the surface of the wood from heat gain in the early stages of a fire. As the fire grows in intensity the plate goes from being a reflector of heat to a conductor of heat into the wood as evidenced by higher temperatures below the wood surface under the plate compared to the unplated wood during ASTM E-119 tests. This occurs at about 10 minutes into the test at a temperature of about 1000°F.



**QUESTION:**

I have been hired by an insurance company to determine the extent of damage to roof trusses exposed to fire. How much fire damage compromises the structural integrity of the truss?

**ANSWER:**

As far as we know, there is no specific information available to determine the strength degradation of plates and lumber after trusses have survived a fire. I contacted some engineers in the industry to get an informal description of their methods for dealing with this situation. Some will specify repair or removal of any charred material. Some will specify repair or removal of lumber that has lost over 10 percent of its cross section due to charring. Some will allow up to 1/16" char depth on the assumption that it will not reduce the strength markedly. Lumber that is discolored by smoke damage but not charred is usually considered acceptable after it has been cleaned. If there is damage to the plate area, the plate is discolored or there is charring under the plate, the plate should be considered ineffective.

Truss chords and webs can be repaired using properly sized and attached lumber scabs over the damaged areas. Joints are often repaired using plywood or OSB gussets that are properly sized and attached to transfer 100 percent of the forces in that joint. In some cases, the entire truss is replaced. All of the engineers I spoke to stressed the fact that these were not one-size-fits-all solutions and that one should consider the specific circumstances before choosing a repair strategy. Each situation requires a separate professional engineering assessment. The most conservative solution is to replace all charred or smoke damaged trusses.

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