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THE MECHANICS OF HOME BUILDING

BY ROB MUNACH

Roof trusses

A roof truss is an engineered building component designed to span longer distances than dimensional lumber without relying on interior partition walls for support. The most common truss, a 2x4 Fink truss, is designed to support several different loads.

On pp. 66-71 of this issue, Paul Johnson and Nathan D. Young show how to build complex roofs with trusses. Whether you're framing a new roof or remodeling an existing truss roof, it's important to know what components make up a truss and how it works.

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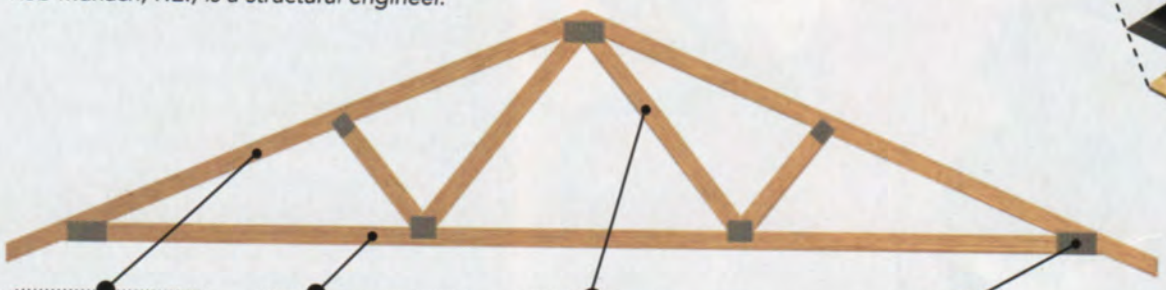


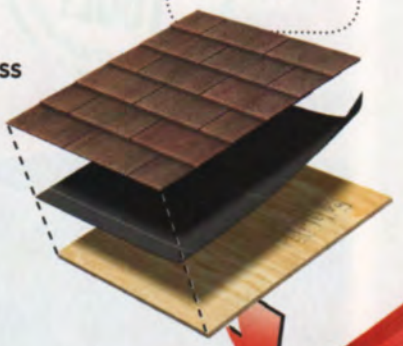
Top chord: *Supports the dead load of the materials used to construct the roof, the live load of workers building or maintaining the roof, and wind and snow loads.*

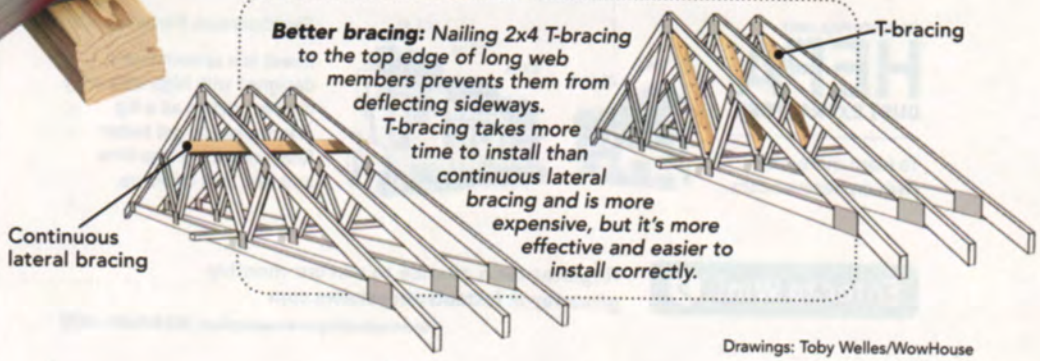
Bottom chord: *Supports the dead load of ceiling materials and the live loads of homeowners accessing the attic as well as the weight of the items stored in the attic. The bottom chord also serves as a rafter tie and keeps the top of the exterior walls from thrusting outward.*

Web: *Helps to support and to transfer the compression and tension forces from one chord to the other. Individually, the web members also are in tension and compression, depending on their location in the truss and the direction of the loads on the truss.*

Nail plates: *Components are fastened together with toothed metal plates that are machine-pressed to the members.*

Dead loads: *The weight of the roof, the truss itself, attic insulation, floor sheathing, ductwork, and drywall used for the ceiling.*

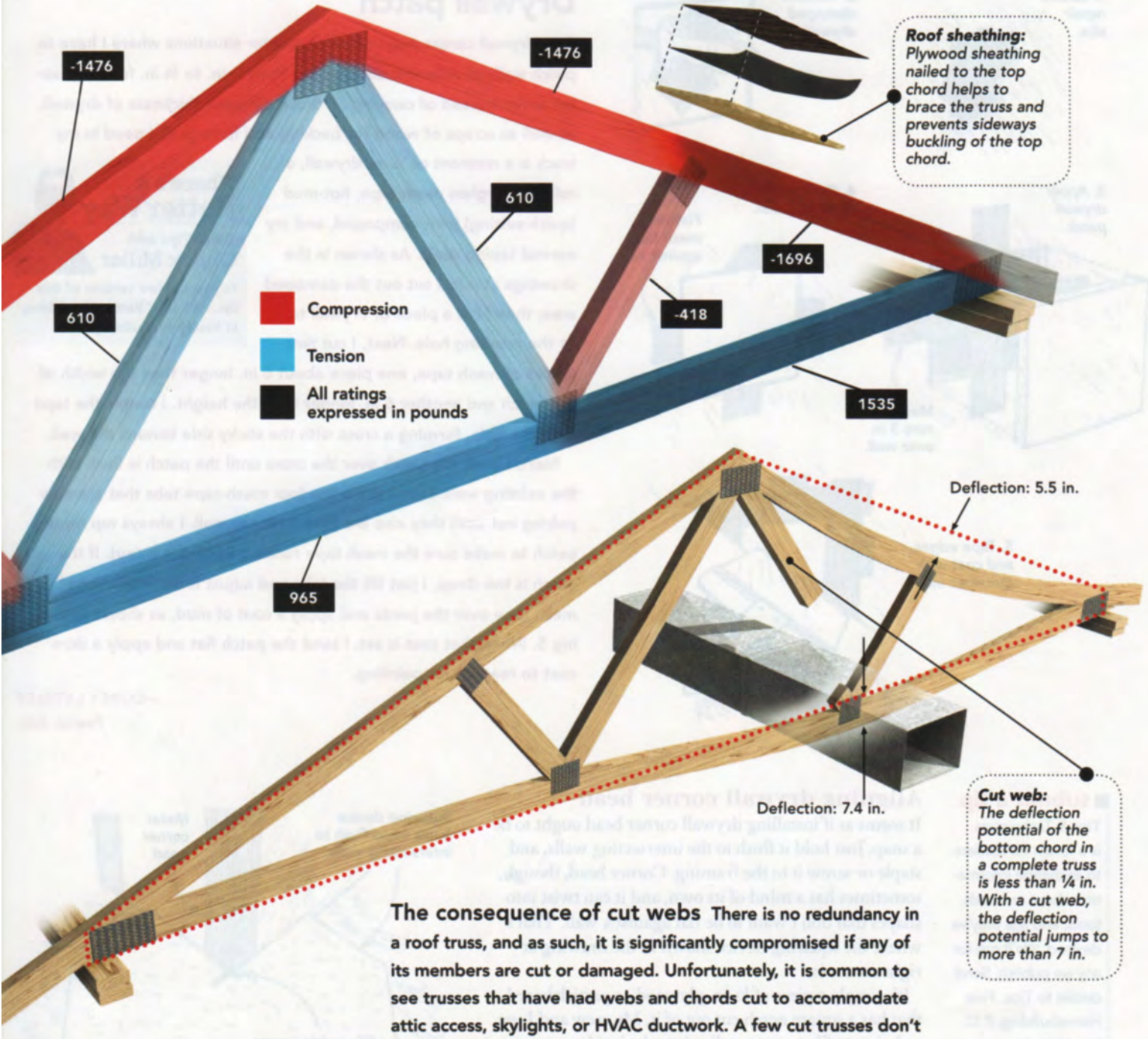




Better bracing: *Nailing 2x4 T-bracing to the top edge of long web members prevents them from deflecting sideways. T-bracing takes more time to install than continuous lateral bracing and is more expensive, but it's more effective and easier to install correctly.*

Drawings: Toby Welles/WowHouse

Truss performance by the numbers In a truss, the bottom chord and the top chord are under tension and compression forces as a result of the loads on the roof. Which chord carries tension and which carries compression depends on the direction of the overall loading on the truss. The loads on the truss are generally in a downward direction, but may turn upward during extreme wind. The numbers below are the actual compression and tension ratings of a truss that has been modeled with a combined dead, live, and snow load of 40 lb. per sq. ft. They illustrate the push-pull relationships of all the truss members.



The consequence of cut webs There is no redundancy in a roof truss, and as such, it is significantly compromised if any of its members are cut or damaged. Unfortunately, it is common to see trusses that have had webs and chords cut to accommodate attic access, skylights, or HVAC ductwork. A few cut trusses don't necessarily lead to catastrophic roof failure, because the roof acts like a large diaphragm and because partition walls below usually pick up some of the roof loads. However, the deflection that can occur when truss members are incorrectly altered can be substantial, which can lead to damage of interior finishes and materials.