

# TECHLINE

## Properties and Use of Wood, Composites, and Fiber Products

### Small-Diameter Round Timber Demonstration Structure



Throughout the West, our National Forests face increased risk of catastrophic wildfire because of an overabundance of dense, overstocked forest stands. This situation results from more than 50 years of effective fire exclusion. To restore the open, parklike setting that existed in presettlement times, these stands need thinning followed by prescribed fire. Such restoration is expensive, but if we can find economic uses for the thinning material, some of the costs can be offset. The Forest Products Laboratory (FPL) has been exploring the concept of using small-diameter timber for roundwood structures, such as in this covered picnic shelter demonstration structure.

This research structure demonstrates the use of small-diameter ponderosa pine, which came from the Shasta-Trinity National Forest near Hayfork, California. The average diameter of these round timbers is approximately 8 in. (20 cm), but the structure can be designed to use material as small as 4 in. (10 cm) in diameter.

Small-diameter ponderosa pine is particularly difficult to use because timber of this size typically contains a large proportion of juvenile wood. Leaving the timber in the round, rather than cutting it into lumber, retains more of its strength. Sawing exposes the juvenile core, which is considerably weaker. Leaving the material in its round form, with its natural taper, also minimizes processing costs and improves the economics of forest restoration.

#### Structure

The structure is designed to show how roundwood timbers, with their natural taper, can be used in buildings. The treated ponderosa pine *posts* are sunk 4 ft (1.2 m) into the ground. The treatment is to prevent attack by insects and



decay organisms. The *roof trusses* are untreated ponderosa pine. Critical to using roundwood timbers are the connections.

#### Connections

The structure is being used to evaluate the performance and demonstrate the use of several types of connection systems.

#### Dowel Nut

The center of the structure has an opening that is formed using vertical roundwood timbers in a compression ring. The compression ring is joined to the roof trusses using dowel nut connections.

#### Fitch Plate

The roof trusses are fastened to the posts using fitch plate connections. The fitch plate transfers outward thrust from the truss to the tension cable. The posts support only wind loads and the downward load-bearing force of the structure.

#### Shear Key

The outer edges of the roof truss members are joined together with shear key connections. Although both top and bottom chords are in compression, the forces are unequal, creating a shearing force between them. The shear key is inserted to counteract this shear force.

#### Concentric Finger Joint and Thumb Joint

In the middle of the third section, two new types of connections are demonstrated. The top is a concentric finger-jointed connection and the bottom is a thumb joint. Both connections use an adhesive to join the two surfaces. Research on performance properties of these connections is still underway.



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### **Tension Cable**

At the outer edges of the vertical support posts, a tension cable keeps the roof from pushing the vertical supports outward. The ends of the cable are connected to a spring system that maintains tension on the cable.

### **Roof**

The roof is unusual because it integrates several different roof systems. We are evaluating the performance of different roof systems for prolonging the durability of wood shingles. There are two elements of the roofing system—the underlayment and the shingles.

### **Underlayment**

Four different underlayment systems are being evaluated for their effectiveness at moisture control and minimizing mold and mildew:

1. Plywood and felt
2. Plywood, felt, lath, and battens
3. Plywood, felt, and cedar breather spacer
4. Battens only

### **Shingles**

Shingles from three tree species (western redcedar, northern white-cedar, and Southern Pine) are being evaluated for durability. Various treatments for improving durability are also being evaluated.

### **Demonstration Structures**

This structure showcases various engineering approaches that could be used in a roundwood structure—no building in actual use would incorporate all these engineering design elements. The Forest Products Laboratory hopes to develop partnerships with others who are interested in pursuing the concept of roundwood structures.

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