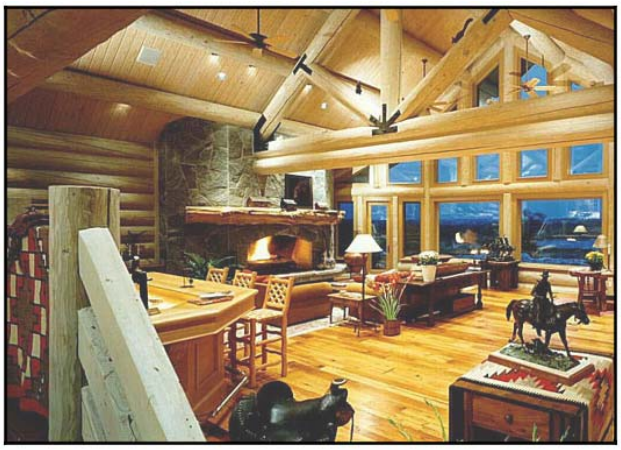
TechLine

Forest Products Laboratory

Better Utilization of the Dead Tree Resource



In Montana, 80% of logs used in log home manufacture are cut from standing dead trees, most killed by insects and wildfires. Log home manufacturing provides a high-value use for such material and is an excellent source of local employment.

Background

Structural grading of logs used by the log home industry is currently based on visual methods. This is probably an overly conservative process. The lumber industry has used mechanical grading for over 40 years as a more precise method of assigning properties to structural lumber intended for engineered systems (such as floor and roof trusses and wooden I-joists). However, no such system exists for structural round timber beams.

Objective

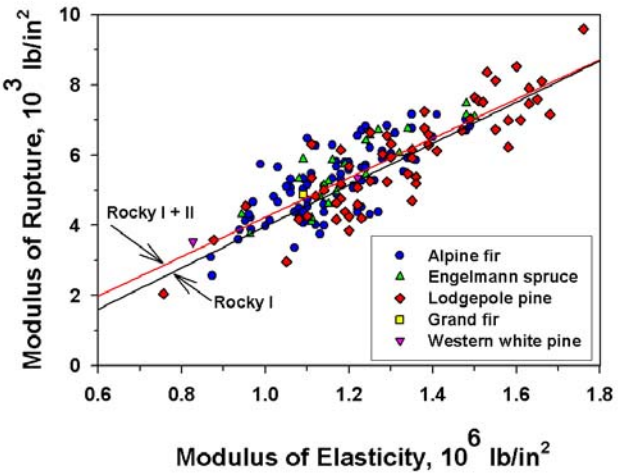
The goal of this study was to develop the technical basis for a mechanical grading system for round timbers for use primarily by the log home industry. Cooperators in the study were the USDA Forest Service, Forest Products Laboratory, Madison, Wisconsin; the University of Idaho, Moscow, Idaho; Rocky Mountain Log Homes, Hamilton, Montana; and Timber Products Inspection, Inc., Vancouver, Washington.

Approach

Rocky Mountain Log Homes suggested an initial focus on 9-in.-diameter logs of the Engelmann Spruce–Alpine Fir–Lodgepole Pine species grouping. In phase I, researchers developed a prototype machine for nondestructive evaluation of logs in transverse vibration. The researchers selected 120 logs from the inventory at Rocky Mountain Log Homes to be visually graded by Timber Products Inspection and nondestructively tested using the prototype machine. The logs were then shipped to the Forest Products Laboratory and the University of Idaho for testing. The resulting data provided sufficient information for a proposed grading system. In phase II, an additional 108 logs were tested to evaluate and refine the proposed grading system.

Outcome

Phase II of the study demonstrated that the proposed grading system did an excellent job of predicting beam properties. As expected, the system was virtually independent of species.



Relationship between bending strength and stiffness.

This research shows engineers that more confidence can be placed in mechanically graded timbers where each piece has been visually graded and nondestructively tested for its properties (Table 1). Further, a mechanical grading system allows engineers more flexibility in specifying only the properties required for a particular application, thus promoting efficient use of the forest resource. This research also shows producers that higher yields are possible through mechanical grading for properties equivalent to those specified by visual grades (Table 2). This makes their operation more profitable and supports the local economy.

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Table 1. Strength for specified stiffness

Mechanical grade		Strength of visual grades		
Stiffness	Strength	No.1	No.2	No.3
0.9	775	--	--	525
1.1	1200	110	900	--

Table 2. Estimated grade yield for equivalent stiffness

Stiffness (10^6 lb/in^2)	Mechanical grade (%)	Visual grade (%)		
		No.1	No.2	No.3
0.90	100	--	--	18
1.10	97	54	20	--

Next Step

Research has demonstrated the potential benefits of the proposed mechanical grading system to the producer and the engineer. Several other technical issues may require investigation.

For log home manufacturers to use the proposed grading system, the obvious economic benefits must be weighed against the increased cost of installing new equipment. Potential markets for the new product must be investigated, and perceived future economic health of the housing industry considered.

In the meantime, research is continuing on potential uses of the new technology for round timbers cut from small-diameter trees of western species for use in other types of structures.