

Probabilistic Modeling of Glued-Laminated Timber

The current methodology for determining allowable properties for glued-laminated timber (glulam) is the industry standard ASTM D 3737. This deterministic method is based on clear wood properties of wood and strength-reducing defects, such as knots.

Background

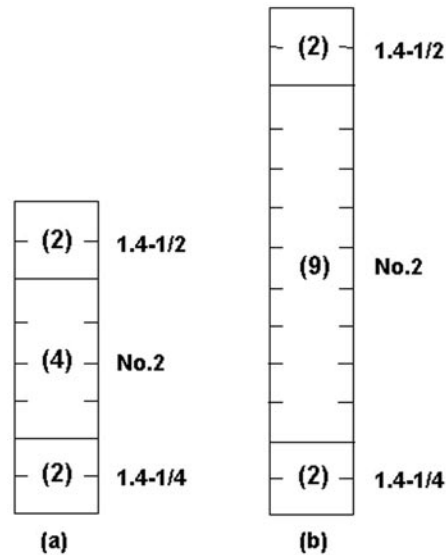
To validate the glulam model using actual test data, we first developed an experimental study. We recently completed a comprehensive test program involving the evaluation of ponderosa pine glulam made from small-diameter timber. These glulam members were tested in edge-wise bending, flat-wise bending, axial tension, and beam shear. In addition, we also gathered matched lumber samples and have been conducting laboratory tests to characterize the statistical distributions of mechanical properties for each of the lumber grades.

Objective

The objective of this study is to develop a probabilistic-based glulam model that uses mechanical properties of lumber as input.

Approach

We are developing a user-friendly probabilistic glulam model that takes mechanical property information for lumber (bending, tension, and shear) and predicts the statistical distributions of glulam bending, tension, and shear. The ponderosa pine data gathered from



Glued-laminated timber combinations made from E-rated ponderosa pine lumber.

our comprehensive laboratory test program will be used for validating the modeling results.

Expected Outcomes

This model will serve as a design tool for developing new combinations of glulam, as well as a research tool for evaluating the effects of changing material properties. The ultimate goal is to incorporate this mechanics-based model in ASTM standards for determining allowable properties of glulam.

Timeline

The working model was written in 2004. Data to validate the model are being collected in 2005.

Cooperators

USDA Forest Service, Forest Products Laboratory
American Institute of Timber Construction,
Englewood, Colorado

Test beams and lumber were donated by Imperial Laminators, Inc., Eagar, Arizona.

Contact Information

Roland Hernandez
USDA Forest Service
Forest Products Laboratory
Madison, WI 53726-2398
(608) 231-9228
rhernandez@fs.fed.us