

# Bamboo Technologies

## EXECUTIVE SUMMARY OF RESEARCH REPORTS

### INTERNATIONAL CERTIFICATION

**Issued by** International Code Council Evaluation Service (ICC-ES)  
**Report Title** *Structural Bamboo Poles*  
**Report# date** ESR-1636, November 1, 2004  
**Conclusion** Structural bamboo poles (*Bambusa stenostachya*) of Bamboo Technologies for Type V Residential Construction comply with the 1997 Uniform Building Code, the 2003 International Building Code (IBC) and the 2003 Residential Building Code (IRC) as an alternative material and method of construction. The report establishes structural design values and methodologies for the bamboo.

### STRENGTH

**Laboratory** Washington State University, Wood Materials and Engineering Laboratory, College of Engineering and Architecture  
**Report Title** *Mechanical Properties of Bamboo*  
**Report# date** WMEL 01-047, April 12, 2002  
**Conclusion** The specimens had an average MOE of 2298 ksi, an E-Tension of 1737 ksi, an E-Compression 4-in. Gage of 2207 ksi, an E-Compression Crosshead of 693 ksi, a 2.0% shrinkage in Diameter, 2.5% shrinkage in Thickness and 0.2% shrinkage in Length. The design values are computed according to AC162.

Outline of WMEL 01-047 Report Results and comparison with Douglas Fir:

Description	WSU Test Average	Design Values for Bambusa Stenostachya Vietnam (BSV)	Design Values for Douglas Fir U.S.	Design Values Comparison Bamboo (BSV) vs. Douglas Fir
Compression	6,249 psi	2,301 psi	1,000 psi	230%
Shear	1,132 psi	413 psi	170 psi	240%
Tension	14,003 psi	4,345 psi	1,000 psi	430%
Bending	14,967 psi	5,875 psi	1,500 psi	390%

### FIRE RESISTANCE OF A 3" POLE

**Laboratory** Omega Point Laboratories  
**Report Title** *Surface Burning Characteristics of a Bamboo Beam Double 3" Pole*  
**Report# date** Report #: 16661-112894, December 19, 2002  
**Conclusion** The specimens had Flame Spread Index of 25 and a Smoke Developed Index of 40, based on the American Society for Testing and Materials (ASTM), Committee E-5 on Fire Standards. Calibrated to red oak flooring, Bamboo Technologies bamboo poles took more than twice as long to ignite, created only 40% as much smoke and burned one-third of the fuel area of red oak.

## FIRE ENDURANCE OF A 2<sup>ND</sup>-STORY BAMBOO FLOOR

- Laboratory** Western Fire Center, Inc. (WFCi)  
**Title** *Research Report on the Fire Endurance of a Bamboo Floor/Ceiling Assembly: Research-Scale Horizontal Test*
- Report# date** #04051, August 23, 2004
- Conclusion** The Bamboo Technologies floor/ceiling assembly exhibited fire endurance characteristics comparable to what would be expected for an unprotected 2 x 10 wood joist floor assembly similarly loaded (13 minutes to structural failure). The bamboo structural members of the assembly exhibited thermal decomposition characteristics similar to conventional wood construction ('popping' or 'explosive decomposition' was not observed).
- The bamboo floor/ceiling assembly, carrying a uniformly distributed load of 40 pounds per square foot, successfully withstood the fire endurance conditions of the ASTM E119 floor test for a period of 17 minutes, 30% longer than the 2 x 10 wood floor joist assembly.

## RESISTANCE TO TERMITES

- Laboratory** Univ. of Hawaii at Manoa, Dept. Plant & Environmental Protection Sciences  
**Report Title** *Resistance of two bamboo species treated with borates to Formosan Subterranean Termites (Coptotermes formosanus) in a No-Choice Test*
- Report# date** October 7, 2003
- Conclusion** Termite mortality was 100% in all treatments. Results indicate that Bamboo Technologies' method of borate pressure treating bamboo poles incurs high termite mortality and prevents all but minor superficial damage to bamboo.

## ENGINEERING

- Laboratory** Washington State University, Wood Materials and Engineering Laboratory, College of Engineering and Architecture  
**Report Title** *Design Considerations for Bamboo Connections*
- Report# date** WMEL 03-003, July 15, 2003
- Conclusion** Connectors for bamboo assemblies used wood design specifications found in Technical Report 12 (TR-12), General Dowel Equations for Calculating Lateral Connection Values (AF&PA, 1999) which describe design procedures for a variety of wood and steel connections using different fasteners. The mechanics based procedures described in TR-12 are an expansion of the National Design Specification (NDS) for Wood Construction (AF&PA, 2001) yield limit equations used for design of dowel type fasteners.
- Mechanics based equations for design on wood and steel connections in double shear taken from TR-12 provided conservative estimates for bamboo connections utilizing the bamboo connections provided by the manufacturer. Methodologies taken from TR-12 are considered a current and effective means for designing wood and steel connections. The TR-12 design methodology under-estimated bolted bamboo connection capacity. These procedures appeared to be appropriate for design of bamboo connections.