

Pole Strength & Juvenile Wood: A Needless Concern

A concern has been raised over the strength of wood poles made from plantation-grown trees managed for maximum growth rate and containing “juvenile” wood in the tops of the poles. Is the strength of these poles less than stated in the ANSI O5.1 standard?

The North American Wood Pole Council reports that, in normal transverse simple cantilever loading situations upon which ANSI strengths are based, such concerns are unnecessary. At the groundline of poles, where stresses are greatest, the presence of juvenile wood in the center of poles is largely irrelevant to strength; at pole tops, where juvenile wood may predominate, stresses are small.

In Terms of the Trades, juvenile wood is defined as “the initial wood formed adjacent to the pith, often characterized by lower specific gravity, lower strength, higher longitudinal shrinkage, and different microstructure than mature wood.” Juvenile wood exists throughout a tree, but it is added only where there is new growth, i.e., the crowns of trees.

Although there is no clear demarcation between juvenile wood and mature wood, juvenile wood in southern pines is generally considered to be the first 10 years of growth, starting from the pith center. Since juvenile wood is added in the growing crown of the tree, the top of the tree stem (commonly, the trunk) has a higher percentage of juvenile wood than the stem bottom. This is true whether a tree grows in a natural stand or a managed plantation. At the lower end of the stem, juvenile wood is encircled by a substantial thickness of mature wood that has grown around it.

Under a simple cantilever load, the maximum stress point for distribution-sized poles is at or near the groundline; the stress in the upper portion of the pole is very low. Since, from an engineering perspective, the inner portion of the cross section has little effect on the bending strength of a solid circular cross section, the amount of juvenile wood at the center of poles is generally of no significance.

The ANSI standard for poles includes a minimum ring count in the outer 2 or 3 inches (depending on pole circumference) of the butt. This requirement ensures adequate strength in the groundline area where maximum stresses normally occur, and it addresses the potential strength issue with rapidly grown trees, whether they grew in a natural stand or a plantation. Although juvenile wood may account for a significant portion of the top of the tree and pole, the stresses in this area of a pole are low and do not typically affect the pole design and selection of pole class.

For design situations other than simple cantilever loading, the ANSI standard provides guidance on the appropriate design value to use – this value takes into account the potential effect of juvenile wood.