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----- The Effects of Weathering on Wooden Crossties

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The characterization of the existing condition of wood crossties is essential to forming effective tie-maintenance planning policy. This report details the results of mechanical testing of ties removed from lines across North America. A better understanding of tie-strength deterioration has been developed from this work. A strength-to-age relationship for ties has been developed for each of the following properties: bending modulus of elasticity, compression parallel to grain, hardness parallel to grain, spike insertion, spike pull-out resistance, and spike lateral stiffness.

These relationships may be used to estimate the properties of ties in track for modeling and maintenance-planning purposes.

Species that had sufficient samples, such as oak and hem-fir, were treated separately. As more data is collected, the same treatment can be given to additional species. The oak and hem-fir models provide examples of commonly used hardwoods and softwoods. The strength prediction models may be used in maintenance costing and planning predictions, such as AAR's Total Right of Way Analysis and Costing System (TRACS). Having ties that lose strength over time in a more realistic manner will improve the ability of TRACS or similar models to predict tie requirements and costs in the future.

In general, we found that tie strength decreases with age for all properties measured. There is an initial period of time when strength values remain near the new tie values. This period is from 5 to 15 years long, depending on average tie life. After this period, there is a rapid decline in strength. This is followed by another period of seemingly relatively stable strength values. This stability finding is likely a product of the way samples were collected. The sample of older ties consists only of the strongest survivors, not the entire population.

The development of a performance specification for wood crossties has been proposed. From the results of the AAR crosstie research work over the past decade, the baseline data is now available to develop such a specification. A specification has been proposed which uses the performance of the current population of crossties as the benchmark. Using accelerated weathering techniques and strength tests developed at the University of Illinois, new products may be evaluated uniformly for long-term performance in a few days.