Extending The Life of Wood Crossties

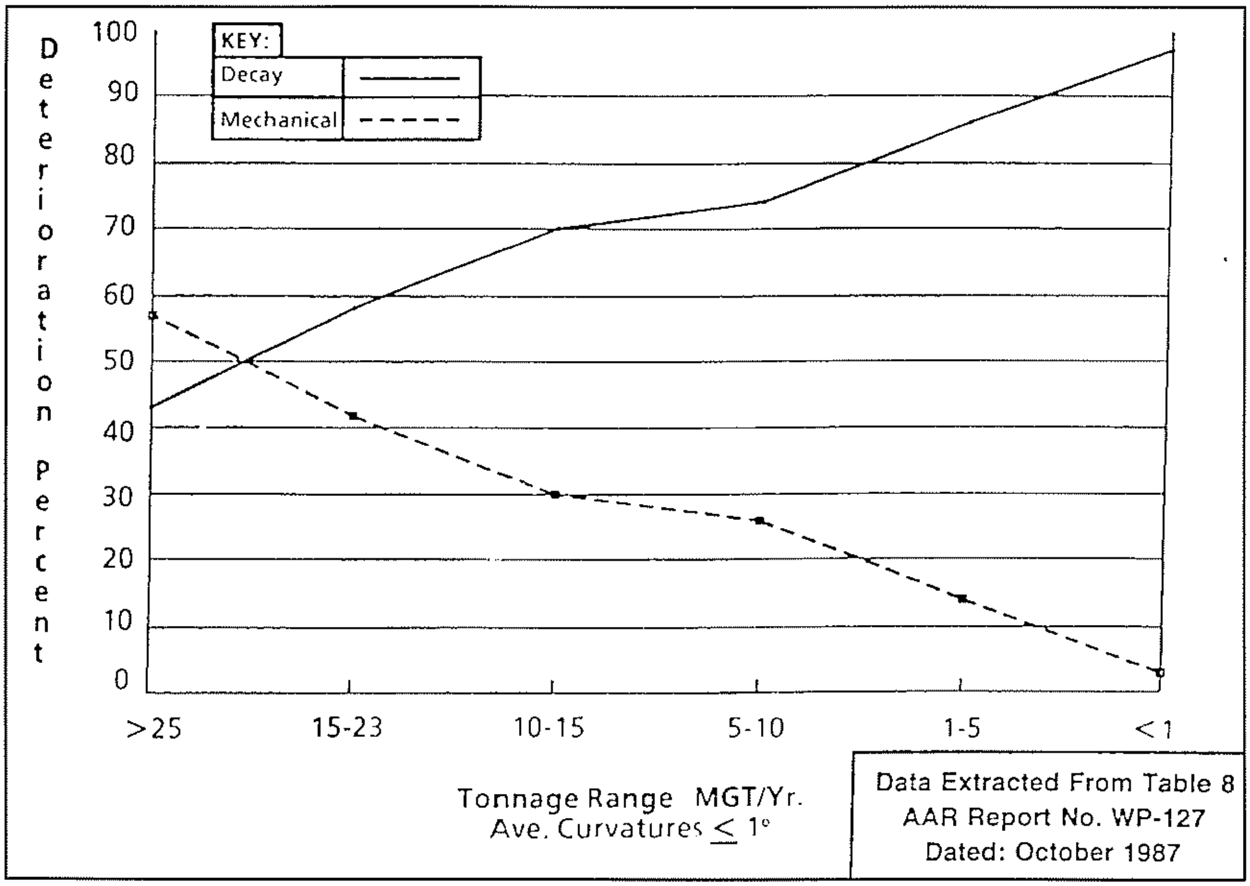

Figure 1 — Causes of tie failure

As railroads strive to improve the overall cost-effectiveness of their various maintenance activities, methods for extending the life of key (and expensive) track components are continuously being studied and tried. The conventional wood crosstie is one such component that is undergoing investigation .

Several studies of the factors that affect tie service life have shown that wood-tie failure can be associated with mechanical degradation, decay (either biological or environmental/weathering related) or "use" (RT&S May 1988, p. 12). One AREA study (1) indicated that decay and wood deterioration were responsible for over 40% of all ties removed. Another recent report (2) quoted AAR data indicating that at annual traffic densities of less than 15 MGT, 70% of the ties failed due to decay. Furthermore, this study stated that on lighter-density lines, decay/weathering is the major mode of failure, accounting for a significant majority of tie failures on light-tonnage tangent track. As tonnage and curvature increased, however, the mechanical modes of wood-tie failure correspondingly increased. These trends are presented in Figure 1 (2). Note that even at moderate-density trackage (10 to 20 MGT per year), tie failures associated with decay made up more than 50% of all the failures. On light-density lines (less than 5 MGT per year), this percentage is significantly higher.

Noting that over 18 million ties were installed in 1986 (3), if 40% of these ties are replaced due to decay, this represents over seven million ties per year.

No. Ties Treated (Mill.)	Ties Treated Effectively (Mill.)	Potential Savings From Extended Tie Life (Life Extension in Years) ($ in Millions)				
		1 Year	2 Years	3 Years	4 Years	5 Years
1.64	1.64	$3.9	$7.5	$10.8	$13.9	$16.8
1.64	1.23	$2.9	$5.6	$8.1	$10.4	$12.6
1.64	0.82	$1.9	$3.7	$5.4	$7.0	$8.4

Figure 2 — Potential savings from in-track tie-treating program

Economic benefits noted

These data suggest that techniques for the extension of the life of the tie, by controlling or reducing the potential for decay, could have significant benefits. This is further supported by the savings shown in Figure 2, which presents a cost-benefit analysis carried out by a major Class I railroad (2). This analysis examined the present worth of an extension in wood-tie life using an in-place tie treatment. As can be seen in this table, even if the treatment is only 50% effective (bottom row), a tie-life extension of two years would be worth approximately $2.20 per treated tie while an extension of five years would be worth over $5 per treated tie. (Note that these savings are based on the average tie life and associated costs of the Class I railroad noted in Reference 2. These savings will change as a function of the actual costs and life of the tie in track).

Extending the life of the wood tie also affects the overall economics of alternate tie materials. This general trend is illustrated in Figure 3, which presents the results of an economic benefit analysis comparing wood vs. concrete ties for a specific base case with a fixed set of assumptions and conditions (4). Note that as the tie life increases, the economics of an alternate tie material (shown in Fig. 3 as the return on investment or ROI for the alternate, concrete tie) changes.

Wood tie treatments

Noting the potential for savings suggested by these types of analyses, several different in-place wood-tie treatments have been developed. These treatments are all aimed at extending the life of ties already installed and in place. In that manner, those ties which are located in track where decay is the dominant failure mechanism (such as light-to-moderate-density tangent track) can be selectively treated. In addition, by treating the ties, in place, the overall treatment costs can be kept to a minimum, since the need for tie removal and handling is eliminated. These in-place techniques utilize several different types of preservatives based on creosote, sodium fluoride (2) and borate (5). While several of these techniques are currently undergoing testing, preliminary analyses indicate good penetration by the preservative(s) and a potential for extension of the tie's service life (2,5).

These techniques, together with other approaches, such as the use of premium components for the extension of the tie's service life, are all being examined as a means of extending the overall in-service life of this key track component. as well as reducing life-cycle costs. This, in turn, follows an overall trend of introducing new components and maintenance practices to reduce the overall cost of track maintenance.

References

(1) American Railway Engineering Association: Report of Committee 3, Tie and Wood Preservation, Volume 78, Bulletin 661, January 1977.

(2) McCarthy. W. T., Use of Under Plate Treatment in Place for Ties, Bulletin of the American Railway Engineering Association, Volume 90, Bulletin 721, May 1989.

(3) Association of American Railroads. Railroad Facts, 1987 Edition, September 1987.

(4) Zarembski, A. M. and Masih, J. T. A., "On the Development of a Computer Model for the Economic Analysis of Alternate Tie/Fastener Configurations." Bulletin of the American Railway Engineering Association, Volume 90, Bulletin 721, May 1989.

(5) Beauford, W and Beal-Preston J., "Preservative Treatment of Wooden Sleepers, *"Railway Technology International"*. Sterling Publications Ltd., London, 1988.

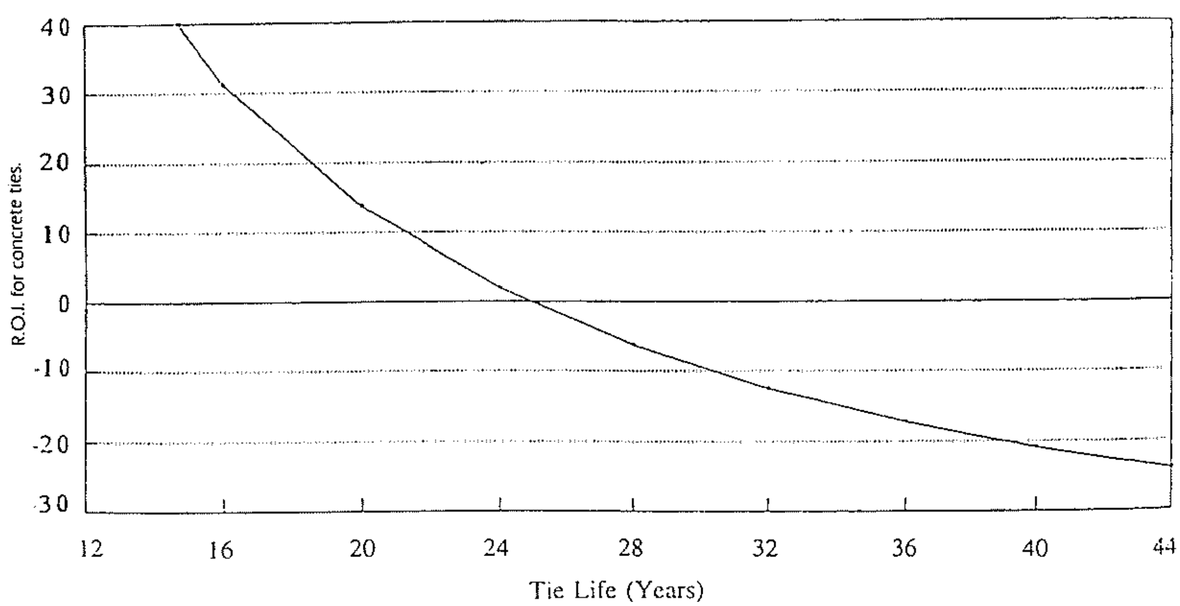

Figure 3 — Economic benefit analysis, wood vs. concrete ties (based on assumptions indicated).