

Report Brief

AAR RESEARCH REPORT

CROSSTIE AND FASTENER TESTS

AT FAST: 1988-1999

by

Rafael Jimenez, Davis Davis,
Carmen Trevizo, and Satya Singh

R-937

April 2000

Results of the Crosstie and Fastener Test at FAST (1988 to 1999) provide data that quantify the performance of the different systems tested, the failure modes, and the effect of truck suspension, species and materials, fasteners, and test section.

Major findings indicate that Truck suspension has been the largest single factor in tie performance during the HAL experiment. The use of premium suspension trucks with better steering capabilities has greatly improved the performance of all ties tested under 39-kip wheel loads.

- Improved-suspension trucks provided a reduction of about 50 percent in the average lateral loads as compared with standard three-piece trucks.
- Gage widening is the largest cause of wood tie maintenance at FAST.
- Tie-plate cutting has not been significant at FAST under improved trucks.
- Under the more severe load environment of standard trucks, Oak hardwood tie performance, in gage widening, was superior to the performance of softwood ties. Under the more benign load environment of premium trucks, the performance of hardwoods and softwoods was equally good. Both achieved markedly improved gage widening performance.
- Although higher than over solid hardwood-tie track, the gage-widening rate over the mixed-specie test sub-zone in the 6-degree curve, where three southern yellow pine ties were installed for every oak tie, was a low 0.07 inch per 100 MGT under improved-suspension trucks.
- There has been no significant gage degradation in the azobe cut-spike (520 MGT) and elastic-fastener sub-zones of the 5-degree curve in Section 31.
- Spruce ties, pre-drilled at 3/4 inch for screw-spike hold-downs, were removed from service after 3 MGT due to the number of screw spikes working out.
- The rough-sided USPL plastic composite ties, consolidated by over 10 MGT of traffic, provided 60 percent more lateral resistance in the Single Tie Push Test than wood ties under similar conditions.
- The type of fastening system and the lateral load environment plays a greater role in determining the long-term degradation of gage-spreading strength than tie type or specie.
- The gage-spreading strength performance of softwood ties with e-clip and SAFELOK® fasteners under standard trucks was comparable to that of softwood ties with cut spikes under improved suspensions trucks in Section 7 at 0.5 L/V static loads.
- With the cut-spike fastening system, increasing gage-spreading loads resulted in further weakening of gage-spreading strength. On the other hand, the elastic fastening systems tested provided increasing gage-spreading strength as gage-spreading loads were increased.
- Out-of-face surfacing and alignment of the Wood Tie and Fastener test zones at FAST is generally required at 100 MGT+ intervals.

Full life cycle testing of ties at FAST is often not practical due to the relatively benign climate. Decay is not a significant factor for FAST wood ties. Due to the climatic, sub-grade, and operating conditions under which tests are conducted at FAST, including the use of improved-suspension trucks which significantly reduce the lateral load environment, the performance of the ties and fasteners tested may differ in revenue service.

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