Missing Fasteners vs. Gage Strength

Maintaining the proper track gage under vehicle loading is a critical function of the tie-fastener system. This ability, referred to as the lateral strength, gage restraint strength, or simply *gage strength* of the track, has been the subject of an earlier *Tracking R&D* (see RT&S, August 1986). While the majority of research and test activity in this area has addressed wood tie track with cut spike fasteners, it has also extended to wood ties and concrete ties with elastic fastening systems.

Concrete tie track

Some recent research focused on the safety aspects of the gage strength of the track, and in particular regard to the effect of missing and non-functioning fasteners on concrete tie track. This activity dealt specifically with the assessment of safety for the track on the Northeast Corridor.[1]

For NEC concrete tie track, a series of tests were carried out to examine gage strength when one or more elastic fasteners were missing from one rail. At first, lateral and vertical load combinations, with an L/V ratio of up to 1.33, were applied to the track with no elastic fasteners missing.[1] The corresponding lateral deflection of the railhead at the point of loading was then measured. The same test was repeated with missing elastic fasteners involving the removal of a series of adjacent elastic clip pairs (both clips) from one rail. Test sequencing covered 3, 11, then 17 missing clip-pairs.

Investigators removed the clips symmetrically about the point of loading, and obtained the resulting load deflection behavior shown in Figure 1. It can be seen in the figure that even with 17 missing fasteners, the maximum loading of 20,000 lbs. resulted in a railhead fastening deflection of less than one inch, because of the lateral support to rail provided by the shoulders in the Northeast Corridor concrete tie.[1]

Wood vs. concrete

This behavior in lateral strength was also matched to comparable test results taken on wood tie track with cut spike fastening. The results, also presented in Figure 1, indicate that the lateral strength of the wood tie track

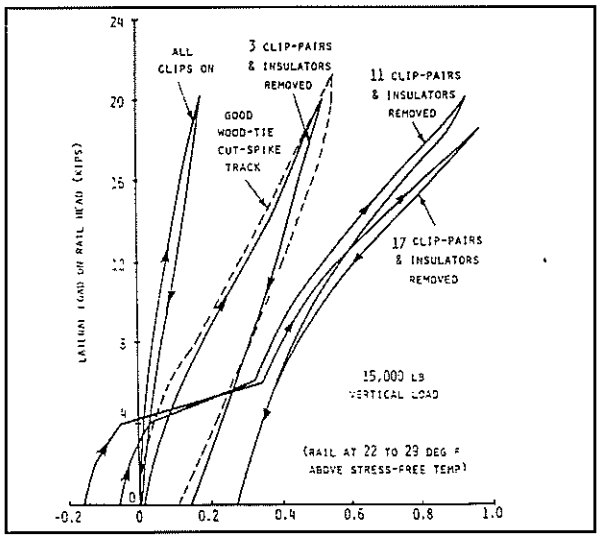

Figure 1 — Rail Head Lateral Displacement (in.)

compares to the lateral strength exhibited by the concrete tie track with three missing fasteners.

Likewise, other data on the lateral gage strength of wood tie track revealed the same characteristic loss in lateral strength with an increasing

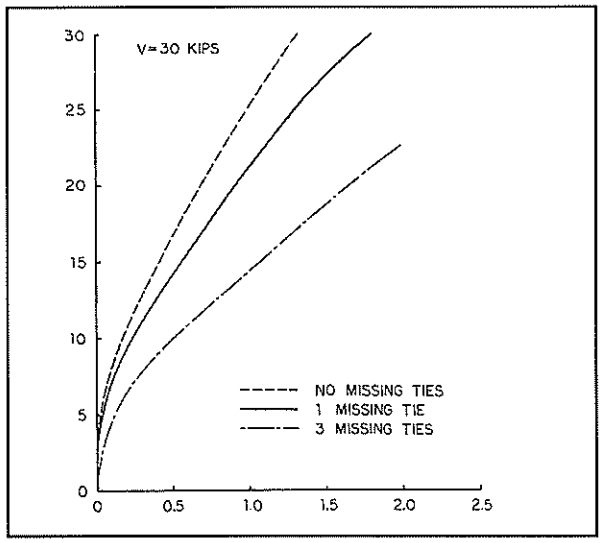

Figure 2 — Rail Head Lateral Deflection

number of missing fasteners. Figure 2 illustrates this. It shows lateral rail restraint of wood tie-cut spike systems under applied lateral and vertical loadings.[2] This data is based on a combination of field validation tests and analytical modeling.

As in the concrete tie case, increasing the number of missing fasteners (with missing ties as well) resulted, with wood, in a direct decrease in lateral gage restraint. However, it should be noted that while the general behavior of the wood tie and concrete tie system presented here are similar, the results are actually based on different loading combinations. Therefore, a direct comparison between wood and concrete tie performance is not appropriate. Also, it can be observed that even with one fastener and tie missing, a lateral rail head deflection of well over one inch can be achieved under suitable load combinations. This agrees with other, independently derived data.[3]

It is obvious that this type of information on the gage-holding ability of various tie and fastener systems can be of a real value to railroad maintenance officers in the development of suitable track maintenance standards, and in the assessment of track conditions.

References:

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3. Zarembski, A. M. and Choros, J., "Laboratory Investigation of Track Gage Widening," Association of American Railroads Report R-395, September 1979.