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Laboratory Fastening System Cyclic Load Test on a Primix Corp.[®] Crosstie

Background

Transportation Technology Center, Inc. (TTCI) completed a laboratory 2-million cycle fastening system load test of a third Primix Corp. crosstie prototype sample on February 16, 2005. The Primix[™] tie is described by Primix Corp. as a recycled tire and plastic composite railroad crosstie that uses a steel reinforced concrete core encapsulated in a composite shell. The filler material in the rail seat area under the composite shell where the cut spikes are inserted was described as dried paint sludge. The two-piece composite shell consisted of glued top and bottom halves.

The cyclic load test is designed to evaluate the performance of the tie's rail seat area using a tie plate and fastener system and a short section of rail through which the loads are applied. The fastening system cyclic load test is one in a series of laboratory tests performed as prerequisite to in-track testing at the Facility to Accelerated Service Testing (FAST) High Tonnage Loop (HTL).

Test Procedure

The Primix test sample consisted of a half-tie with the same 9-inch wide x 7-inch high cross-sectional dimensions of a standard wood tie. A 10-inch section of rail was fastened to the tie sample using a 14-inch tie plate and cut spikes. Two diagonally opposed hold down spikes, two gage-side rail spikes, and one field-side rail spike were inserted without pilot holes to within about 1 inch of the plate using a hydraulic press as shown in Figure 1. The rail base was then slid under the rail spikes and the spikes were driven the rest of the way by impact using a spike maul.

The tie/plate/rail assembly was secured in the cyclic load machine, as shown in Figure 2, where it was subjected to 2-million load cycles. One full cycle consisted of one 22-kip gage-side load and one 22-kip field-side load. The loading rate during the test varied between 137- and 235-cycles per minute.



Figure 1. Cut spikes were inserted without pilot holes using a hydraulic press

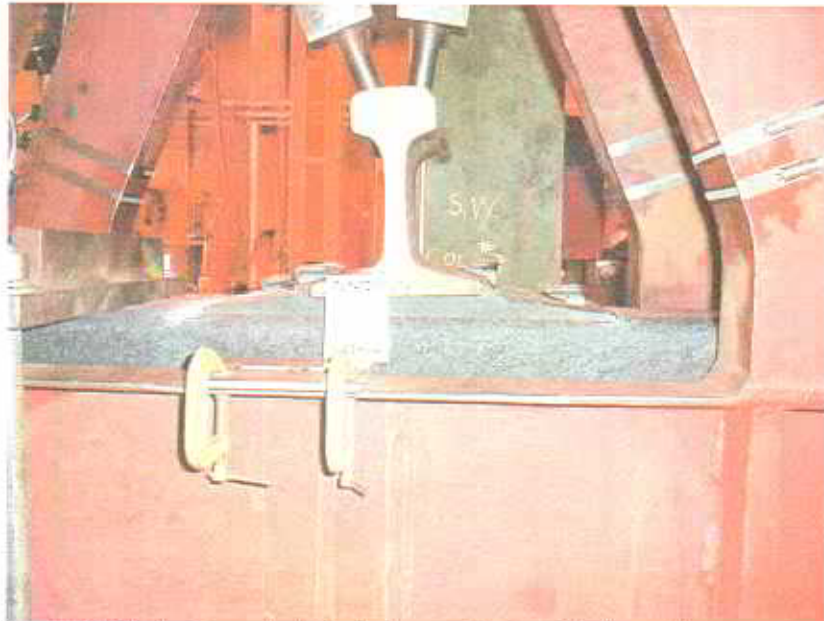


Figure 2. Primix Corp. test tie in the cyclic load test machine

Test Results and Observations

The test was concluded after the successful completion of 2-million cycles. Figure 3 shows that cut spike uplift was not significant during the 2-million cycle test. The maximum cut spike uplift measured was about 7/32 inch.

The tie plate was removed after the test to inspect the top surface of the tie. As shown in Figure 4, with tie plate marks that were less than 1/16-inch deep, tie plate cutting or plate-area deformation was not significant.



Figure 3. Post test photograph shows no significant cut spike uplift after 2-million cycles



Figure 4. Shows no significant tie plate cutting or plate area deformation after 2-million cycles

The test sample was dissected for inspection after the test by separating the glued, two-piece, composite shell as shown in Figure 5.

Inspection of the rail seat area under the composite shell showed no degradation of the paint sludge filler material. The filler material did not appear to have sustained permanent deformation as a result of cyclic loading. The spot welds on one side of a thin sheet-steel plate support in the center of the rail seat area, however, were separated as shown in Figure 6.



Figure 5. Primix tie dissected for inspection

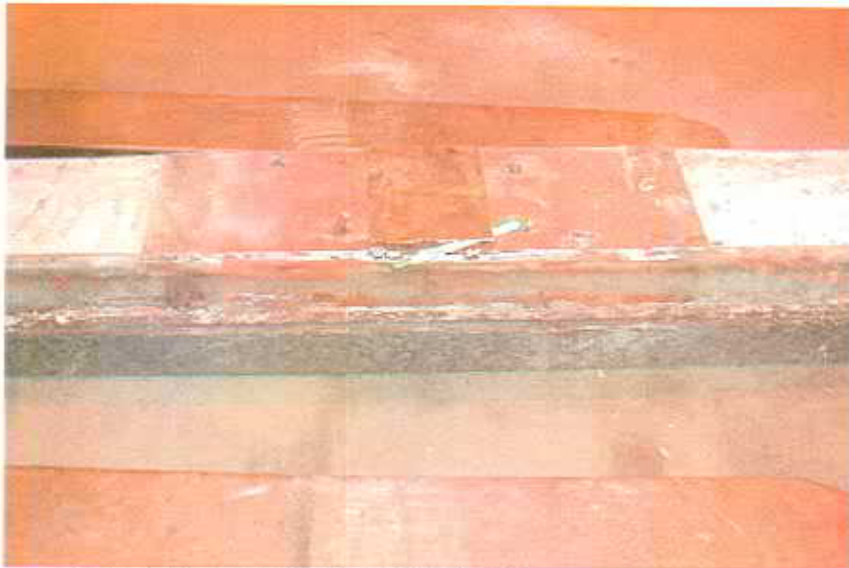


Figure 6. Internal view of the rail seat area

Conclusions

The Primix tie was able to withstand 2-million cycles in TTCl's cyclic load machine. Two-million cycles is approximately equivalent to 9,000 train passes (2 lead axles/car and 110 cars/train). At the conclusion of the test, there was no significant cut spike uplift, tie plate cutting, or plate area deformation. There was no separation of the top and bottom halves of the composite shell. The cyclic loading resulted in the failure of small spot welds in the rail seat support plate. The Primix tie successfully completed TTCl's fastening system cyclic load test.

Please call me if you have any questions about the test.

Sincerely,



Rafael Jimenez

Disclaimer:

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