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EFFECT OF MISSING OR BROKEN FASTENERS ON GAGE RESTRAINT OF CONCRETE TIES

SUMMARY

From 2009 to 2010, the Transportation Technology Center, Inc., measured the gage restraint of a mainline concrete tie track affected by missing or broken fasteners. Measurements were taken at the Facility of Accelerated Service Testing and in revenue service.

A concrete tie rail fastener (Figure 1) provides gage restraint by holding down the base of the with tie clips and by holding the sides in place with insulators pressing against the base of the rail. Missing or broken fasteners can reduce the track's gage strength. This research showed the following:

Missing or broken field side clips were found to have less effect on gage restraint than missing or broken gage side clips. However, missing field side insulators had a greater effect on gage restraint than missing gage side insulators. Gage side clips appeared to play a bigger role than field side clips in preventing gage widening as a result of rail roll. In contrast, field side insulators had a bigger role than gage side insulators in resisting gage widening because of rail translation.

It took eight consecutive ties missing only clips or insulators to reduce gage restraint below the maximum limit. When both clips and insulators were missing, however, it took only three consecutive ties to reduce gage restraint below the maximum limit.

The research presented in this report addresses one of the concerns for the performance of concrete ties under heavy axle load (HAL) train operations, including missing or broken fasteners, rail seat abrasion, pad wear, loss of toe load (hold-down force), improper fastener configuration, and excessive lateral rail movement.

The research is funded jointly by the Federal Railroad Administration and the Association of American Railroads under the HAL revenue service testing program.

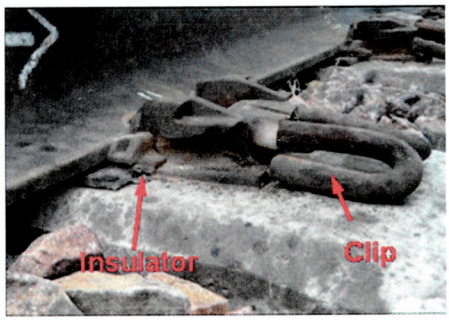

Figure 1: Example of Rail Fastener for Concrete Tie Track (~~Note~~ note that the clip shown is not engaged on the rail)

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BACKGROUND

Gage restraint is a key requirement for track integrity and track strength. It maintains proper track gage for safe train operations. For a concrete tie track, gage restraint is provided primarily by rail fasteners. A rail fastener (Figure 1) often consists of a plate, a pad, two insulators, and two clips on the gage and field sides of the rail.

A rail clip, when engaged on the base of the rail, provides gage restraint through toe load (hold-down force). In contrast, an insulator provides gage restraint through its lateral resistance against the base of the rail.

For concrete tie track under heavy axle load (HAL) operations, the Federal Railroad Association (FRA) and railroads are concerned about several issues from both safety and maintenance perspectives, including missing or broken fasteners, rail seat abrasion, pad wear, loss of toe load, improper fastener configuration, and excessive lateral rail movement. This research addresses the missing or broken fasteners issue.

OBJECTIVES

During HAL train operations, it is inevitable that some rail fastener components, such as clips and insulators, will break or become loose over time (Figure 2 shows an example). As such, there are questions concerning how track integrity or gage restraining capability by rail fasteners may be compromised as a result of failed or missing fasteners and how different parts of a fastener system can affect gage restraint (gage strength). Answers to these questions provided by actual field testing and measurements may help railroads develop and optimize their track maintenance practices.

Figure 2~~.~~ Example of Missing Fasteners -in Revenue Service

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METHODS

Tests were conducted at the Facility of Accelerated Service Testing (FAST) and in revenue service. At FAST, the concrete tie track that was tested uses the fastener system shown in Figure 1. ***At the revenue service western mega site located near Ogallala, NE, the concrete tie track uses the fastener system shown in Figure 2.*** Tests were conducted on both tangent and curve track locations.

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A ~~light~~ portable track loading fixture (~~LTLF~~PTLF) was used to measure gage strength. At each test location, a gage widening force of 9,000 pounds was applied to the gage face five-eighths of an inch from the top of the railhead.~~*(insert some sort of footnote stating that the details in this sentence "are not*~~

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