



# National Transportation Safety Board

Washington, D.C. 20594

## Safety Recommendation

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**Date:** July 27, 2000

**In reply refer to:** R-00-9 through -11

Honorable Jolene M. Molitoris  
Administrator  
Federal Railroad Administration  
400 Seventh Street, S.W.  
Washington, D.C. 20590

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About 6:10 a.m., central daylight time, on September 2, 1998, the 17th through 19th cars and the first two platforms of the five-platform 20th car of westbound Burlington Northern and Santa Fe Railway Company (BNSF) intermodal freight train S-CHILAC1-31 derailed at Crisfield, Kansas.<sup>1</sup> The accident occurred when the 18th car from the locomotive, DTTX 72318, an articulated, five-platform, 125-ton double-stack car, experienced a separation between the floor shear plate and bulkhead bottom angle at the leading end of the car's B platform. The separation allowed the car to sag below the rails, catch a part of a switch, and derail.

The train was traveling 68 mph through the east siding switch at Crisfield, milepost 291.7, on the Panhandle Subdivision of the railroad's Amarillo Division, when it began to derail. The train then went into emergency braking and stopped after traveling about 1/2 mile. The derailment resulted in a pileup involving four articulated multiplatform cars carrying intermodal shipping containers. Some of the containers were breached, resulting in the release of hazardous materials and fires. About 200 people were evacuated within a 5-mile radius. No injuries resulted from either the derailment or the hazardous materials releases. Estimated damage was \$1.3 million.

The National Transportation Safety Board determines that the probable cause of this accident was the structural failure of intermodal car DTTX 72318 due to fatigue cracking initiated when a container was misloaded onto a foreign object. The misloading of the container occurred because of the railroad industry's inadequate preloading inspection procedures for double-stack well cars. Contributing to the accident was the improper and undocumented repair of the car.

All of the parties to the investigation of this accident, including the accident car manufacturer (Thrall Car Manufacturing Company—Thrall), the car owner (TTX Company), the

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<sup>1</sup> For additional information, read Railroad Accident Report—*Derailed of Burlington Northern and Santa Fe Railway Company Intermodal Freight Train S-CHILAC1-31, Crisfield, Kansas, September 2, 1998* (NTSB/RAR-00/01).

Federal Railroad Administration (FRA), the Association of American Railroads (AAR), the BNSF, and the Union Pacific Railroad (UP), have found that all previous weld failures between the floor shear plate and the bulkhead bottom angle on Thrall 125-ton deep-well double-stack cars resulted from the placement of a loaded container on top of a hard foreign object. All agree and have concluded that these weld failures were the direct result of such misloadings. Investigators found that the cracks discovered in Thrall cars were not related to car age, mileage, service pattern, maintenance, or previous repairs but to stress forces caused by the presence of a foreign object on the floor of these cars.

The UP inspections of Thrall cars that ultimately prompted Early Warning Letter 161 (EW-161) provide additional evidence of this phenomenon. Further, inspections of 1,653 cars still in service since EW-161 was issued, in December 1997, have resulted in the repairs of 27 Thrall double-stack container cars, all of which had damage due to foreign objects. No evidence suggests that any of the weld failures found by the FRA or during the EW-161 inspections were the result of any other condition or phenomenon. Therefore, the Safety Board concluded that a direct causal relationship exists between the misloading of a loaded container on top of a hard foreign object and the weld failures at the floor shear plate to bulkhead bottom angle on Thrall 125-ton deep-well double-stack cars.

Since the accident car displayed all of the characteristics inherent in a weld failure due to such misloading, the parties to the investigation were convinced that the initial weld failure occurred as a result of the placement of a loaded container on a hard foreign object. No empirical evidence or evidence from the metallurgical examination supports any other conclusion. Therefore, given the nature and location (bulkhead to bottom angle) of the crack and the similar problems caused by foreign objects in the wells of Thrall cars, the Safety Board concluded that DTTX 72318's original 20-inch lateral fatigue crack was most likely caused by the misloading of a container onto a foreign object.

The postaccident examination revealed that an improper and undocumented repair of the original 20-inch floor crack had been attempted. An 8-inch-long bolt had been improperly welded between the floor shear plate and bulkhead bottom angle as filler metal to bridge the original crack. The repaired area had been painted over. However, a portion of the repaired crack at the bottom of the floor shear plate had not been covered with weld. Under the stress of service, this area became a stress raiser, which caused secondary cracking to extend outside the original 20-inch lateral fatigue crack. The repair area separated during service because of this stress raiser and because of the reduced thickness of the weld repair (0.2 inch), compared to the wall thickness of the shear plate (0.5 inch). Thus, the repair was strictly cosmetic and merely covered, rather than repaired, the cracking.

Safety Board investigators, TTX Company, Thrall, and the AAR attempted to discover the history of the improper repair to DTTX 72318. The Safety Board reviewed Thrall car repair records and histories of cars experiencing cracking or structural failure to determine why the improper repair may have been made to DTTX 72318. However, the absence of records for this repair and the conflicting records on the car's location provided by TTX Company, the AAR, and the BNSF made it impossible to realistically determine who made the repair or when the repair

was made. The lack of documentation for the repair made to DTTX 72318 prevented the Safety Board from determining definitively the cause of the original 20-inch lateral fatigue crack.

Loading a container onto a foreign object, such as a track spike, brake shoe, or interbox connector (IBC), is the only type of “improper securement” noted in AAR container loading and securement standards and inspection forms that is undetectable once the container is loaded. This is particularly true for longer containers, on which it is difficult to see whether one end of the container is higher than the other and possibly resting on a foreign object. If the end of a 40- or 48-foot-long container is raised no more than 6 inches, it may still appear level and pass any overhead clearance restrictions. Thus, the only effective way to ensure that foreign objects have been removed or that the car is “clean” is to inspect the car well when it is empty. However, current methods of loading do not ensure that this occurs.

The emphasis placed on postloading and predeparture inspections is illustrated by the descriptions given to Safety Board investigators of inbound and outbound inspection procedures by the Conrail carman at Croxton Yard and the two BNSF carmen at Corwith Yard and by the AAR’s *Standard Operating Procedure [SOP] for Intermodal Securement*, inspection forms, and related training videos. Such an emphasis on postloading and predeparture inspections belies the importance of preloading inspections to ensure that car wells contain no foreign objects.

The procedures outlined by the Croxton and Corwith carmen illustrate actual operating conditions for many intermodal ramp operations, under which it is difficult to perform preloading inspections. At Croxton, the carman and the contractor personnel were allowed to work the train simultaneously. The Croxton carman stated that the container cars were not always empty when he inspected them because the contractor crew routinely unloaded containers from the inbound train and immediately loaded the train for the outbound movement. The carman said that most of the time he followed the contractor crew while conducting his inspections to avoid injury and to avoid getting in the way of the loaders. Therefore, the carman could not perform a consistent, comprehensive inspection of the car wells for foreign objects.

In addition, the Croxton carman stated that he conducted his night inspections from a repair truck with a search light. He said that although he was positioned to observe both the car’s condition and the container’s position, he would have been unable to completely see the floor of an empty car. Therefore, at each point, the carman’s inspection was focused on ensuring the securement of the loads and the operation of car safety appliances before departure and not on inspecting the car wells for foreign objects.

When the car was placed in the accident train, the only opportunity to inspect the cars was the predeparture inspection conducted by the carmen. Since DTTX 72318 was already loaded at that time, the carman could not have determined whether the car was structurally sound (beyond the obvious sagging or structural failure) or have seen whether a container was loaded on top of an object. The Corwith carmen’s inspection was limited to postloading, predeparture securement items emphasized in the AAR training and inspection forms. This situation is typical of many intermodal facilities, where postloading securement, not preloading inspection, is emphasized. The Safety Board, therefore, concluded that current preloading inspection procedures are inadequate

to ensure that foreign objects are detected on the floors of well cars, particularly Thrall 125-ton double-stack cars.

Despite the fact that the AAR SOP requires that foreign objects be removed from rail car wells or surfaces, inspecting the wells of intermodal cars before loading is not included as a safety check on the AAR *Intermodal Securement Safety Audit Form*, nor is it listed as a securement failure on the *Internal and Inter-road Securement Failure Report*. Although these forms cover postloading and predeparture securement and inspection comprehensively, the only preloading consideration is to ensure that containers and trailers are structurally sound with closed and locked doors and that trailer hitches, IBCs, and other loading equipment are in safe working order. In short, the primary emphasis is on the importance of load securement and postloading inspection.

In the latest AAR video, the removal of foreign objects is briefly mentioned by a narrator, standing next to an intermodal flatcar, who says, "Ice and snow can build up and prevent a container from making proper contact. Brake shoes, IBCs, and rocks can also prevent a container from seating properly, so remember to remove these items before loading a container." This segment takes about 30 seconds of the 17-minute video and could be easily missed. The topic of removing foreign objects before loading intermodal cars is mentioned in passing without emphasis or example, and the only reason cited for its importance is the need to ensure the container is seated correctly. The FRA has no inspection standards and procedures for intermodal cars.

The Safety Board concluded that had the railroad industry or the FRA placed sufficient emphasis on ensuring a complete preloading inspection of all well cars, the structural failure of DTTX 72318 may not have happened. The Safety Board also concluded that the EW-161 inspections did not address the root cause of the resulting structural failures: loaded containers placed on foreign objects on the floors of double-stack container cars. The Safety Board further concluded that to prevent the structural failure of double-stack container cars, all such cars must be inspected while empty to ensure that foreign objects are eliminated from the wells and platforms. This inspection can best be done at the intermodal facilities as part of a comprehensive program that focuses not only on postloading securement but also on preloading conditions when the car is empty.

To address long-term solutions to intermodal equipment problems, the FRA is conducting a nationwide intermodal securement safety audit focusing on topics such as loading practices and the removal of foreign objects from car wells. The 18-month safety audit begun in October 1999 should be completed in April 2001. One result of the FRA audit will be to determine whether new regulations regarding intermodal industry practices are needed.

Railroad intermodal traffic has increased an average of about 15 percent per year, from 3 million trailers and containers in 1980 to over 8.7 million in 1997. Intermodal traffic accounts for more than 17 percent of railroad industry revenue, second only to coal, at 22 percent. The BNSF's Director of Hazardous Materials estimated that, in 1999, roughly half of the BNSF's hazardous materials were transported intermodally. In addition, according to 1998 AAR statistics, 486,300, or 5.6 percent, of the 8,772,663 total intermodal shipments in the United States consisted of hazardous materials. These statistics prompt the Safety Board to recommend

that more immediate action be taken to develop comprehensive safety inspection standards and procedures for all intermodal cars. Such procedures must include inspections of those areas of cars that have been identified as subject to misloading and catastrophic structural failure. In addition, the procedures should address other issues ultimately identified in the FRA's audit.

Therefore, the Safety Board recommends that the Federal Railroad Administration:

Audit the Association of American Railroads and individual railroad equipment repair databases to determine whether adequate quality control procedures have been incorporated to ensure that database information is complete, accurate, and secure. Direct the Association of American Railroads and the individual railroads to correct all identified deficiencies. (R-00-9)

Require that double-stack well car floors be inspected and that all foreign objects be removed before loading. (R-00-10)

Revise 49 *Code of Federal Regulations* Part 215 to include comprehensive safety inspection standards and procedures for all intermodal cars. (R-00-11)

The Safety Board also issued safety recommendations to the Class I Railroads and the American Association of Railroads. Please refer to Safety Recommendations R-00-9 through -11 in your reply. If you need additional information, you may call (202) 314-6170.

Chairman HALL and Members HAMMERSCHMIDT, GOGLIA, BLACK, and CARMODY concurred in these recommendations.

By: Jim Hall  
Chairman