National Transportation Safety Board

Railroad Accident Brief

Derailment and Subsequent Collision of Two Metro-North Passenger Trains

Accident No.:	DCA13MR003
Location:	Bridgeport, Connecticut
Date:	May 17, 2013
Time:	6:01 p.m. eastern daylight time
Railroad:	Metro-North Railroad
Property damage:	$18.5 million
Injuries:	65
Fatalities:	0
Type of accident:	Collision

The Accident

On Friday, May 17, 2013, at 6:01 p.m. eastern daylight time, eastbound Metro-North Railroad (Metro-North) passenger train 1548, which had departed Grand Central Terminal (GCT), New York, New York, headed toward New Haven, Connecticut, derailed from main track 4 at milepost (MP) 53.25 on the New Haven Line Subdivision 7. The derailed train was then struck by westbound Metro-North passenger train 1581, which had departed New Haven, Connecticut, bound for GCT. As a result of the collision, at least 65 persons were injured. Metro-North estimated about 250 passengers were on each train at the time of the accident. (See figure 1.)

Figure 1. Metro-North passenger trains: 1548 (right) and 1581 (left).

Emergency Response

At 6:02 p.m., the first 911 emergency call was received by the Fairfield Emergency Communications Center (Fairfield 911) in Fairfield, Connecticut. The call was from a passenger aboard the derailed eastbound train. Several additional calls were received from other train passengers. About the same time, the Bridgeport 911 call center received its first call from a motorist who was traveling on nearby Interstate 95 (I-95).

At 6:03 p.m., Fairfield 911 dispatched American Medical Response Fairfield County ambulance services and the Fairfield fire department. At 6:09 p.m., the Fairfield fire department arrived and established a command post. At 6:11 p.m., the first ambulance and the Bridgeport fire department arrived on scene. The Fairfield emergency responders directed the self-evacuated passengers to a nearby vacant lot, which served as a temporary holding area. Of the 65 injured passengers, 53 sustained minor injuries and 12 sustained serious injuries.

Trains Involved

Both Metro-North trains consisted of eight passenger railcars designated by Metro-North as M-8 series. The M-8 series passenger cars are self-propelled, electrically powered, and capable of operating on either an electrified third-rail or an overhead catenary system.

After the required predeparture brake tests, the eastbound train departed on schedule at 4:42 p.m. The train was operating on main track 4. Prior to the derailment, the last station stop for the train was the Fairfield Metro Station. After the train departed the Fairfield Metro Station, it accelerated to 74 mph. As the train approached MP 53.25, the locomotive engineer said that he thought he saw a track defect in the left rail under the I-95 overpass. The locomotive engineer told NTSB investigators he might have seen the track defect but it was too late to stop. All eight cars in the train derailed upright. The derailed third and fourth cars (9246 and 9247) encroached onto the adjacent main track. The engineer said that moments later he saw the westbound train pass on the adjacent track, and he felt the passing train strike his derailed train.

After the required predeparture brake tests, the westbound train departed New Haven Station at 5:35 p.m. After stopping at the Bridgeport Station on track 3, which was the last stop before the collision, the westbound train crossed over to main track 2 and accelerated to 74 mph as it approached MP 53.25. The engineer of the westbound train said that moments before the collision, he saw an arc and what he thought were falling catenary wires. He said that he immediately applied the emergency brakes of his train. As the westbound train slowed, its lead car (9193) collided with the third car (9246) in the eastbound train. The lead car of the westbound train sideswiped 9246, scraping the side of the car. At the time of impact, the westbound train had slowed to about 23 mph and the eastbound (derailed) train was completely stopped.

Broken Compromise Joint Bars

At the point of derailment, investigators found a pair of broken compromise joint bars on the north rail of main track 4. Compromise joint bars are used to join two rails of different sizes by compensating for the different heights of the two rail heads. (See figure 2.) The compromise joint was two separate bars that were bolted to the webs of the two rails. The two rails were

136- and 131-pound rails.[1] The compromise joint bars had been installed on April 4, 2013, during a scheduled joint bar inspection, to replace broken bars.

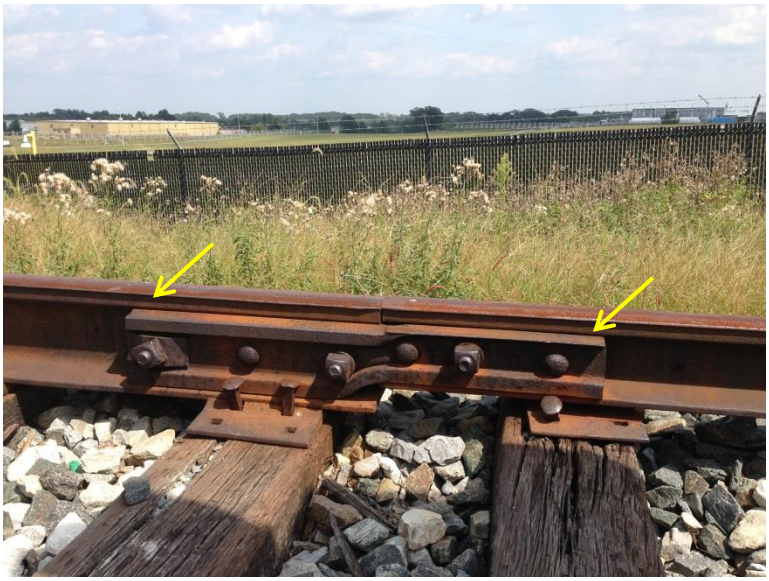

Figure 2. Photograph of an exemplar compromise joint bar denoted by arrows (not Metro-North).

The broken compromise joint bars were examined at the accident scene by NTSB investigators and in the NTSB Materials Laboratory in Washington, DC. The examination found that the gage side bar, which is the bar closest to the center line of the track, exhibited crack arrest marks indicative of fatigue cracking. The fatigue cracks emanated from multiple origins at the bottom of the bar. The compromise joint bar on the field side, which is the bar opposite the gage side, also contained a fatigue crack originating at the bottom of the bar. (See figure 3.) The fatigue propagation extended partially through the middle portions of the compromise joint bars.

[1] References to 136-pound rail and 131-pound rail refer to the rail section weight per yard.

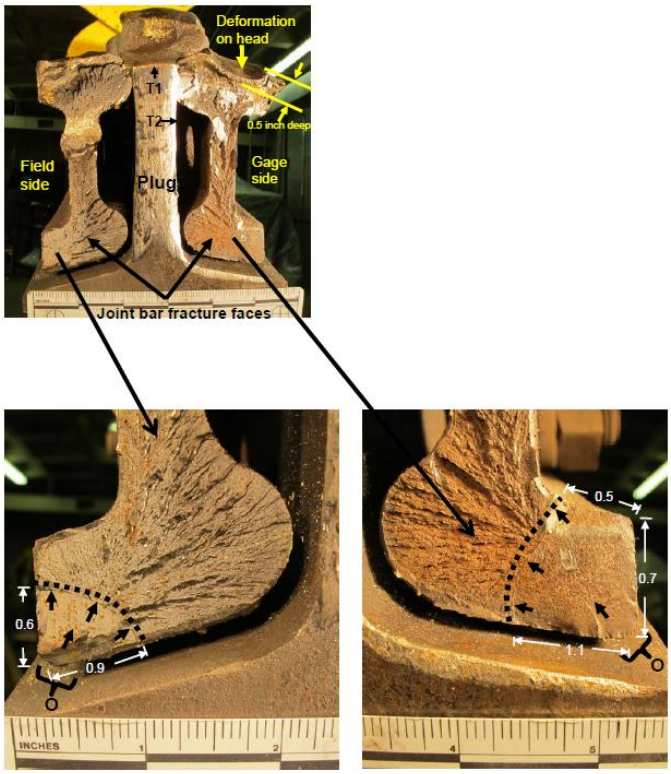

Figure 3. Fractured pair of compromise joint bars and rail showing the east fracture face (top photo) and close-up photographs of the leg portions of the compromise joint bars (bottom photo). A fatigue crack emanated from the lower corner of each leg portion of the compromise joint bars in the areas indicated by brackets "O."

By measuring the exposed portions of the fatigue cracks, investigators determined that the gage side bar, which had the largest and oldest fatigue crack, was the first bar to break. The exposed portions of fatigue cracks on the field side bar were smaller; this finding indicated that it was the second bar to break.

Investigators also measured the joined rails to determine whether the rail head running surfaces were properly matched. By design, the compromise joint bars create a 0.1875-inch difference at the base of the rails by raising the smaller rail. This action aligns and levels the rail head running surfaces. However, in this case, the 131-pound rail was worn. The running surface of the 131-pound rail was lower than that of the 136-pound rail; with a vertical rail end mismatch at the joint of about 0.3 inch. A mismatch of this magnitude should have been noticeable by sound and feel when traversed by an inspector in a hi-rail inspection vehicle. This mismatch also would have been noticeable to a trained inspector who walked the track. Federal Railroad Administration (FRA) regulations at Title 49 *Code of Federal Regulations* 213.115, "Rail End Mismatch," allow no more than a 0.125-inch mismatch on the tread (that is, head) of the rail end for a class 4 track.[2]

[2] The track at MP 53.25 was class 4 track. The maximum allowable operating speed for a passenger train on class 4 track is 80 mph.

On May 15, 2013, 2 days before the accident, the last track inspection in the area of the derailment was performed from main track 2 by Metro-North track inspectors in a hi-rail vehicle.[3] The inspectors documented a "joint with hanging ties" (that is, insufficient ballast support) and "pumping under load" (that is, vertical deflection) at the location of the derailment on main track 4.[4] No corrective action was documented in the report. During an on-scene examination of the derailment area, NTSB investigators found conditions consistent with deflection under the joint. The NTSB investigators determined the combination of the rail-head mismatch and the vertical deflection under the joint caused the compromise joint bars to fail from fatigue cracking.

The gage side of the rail on main track 4, including the compromise joint bar, would not have been visible to the Metro-North inspectors riding in a hi-rail vehicle on main track 2. Also, the small crack at the bottom of the field side compromise joint bar on main track 4 would not have been visible to the track inspector because of the distance of the vehicle from main track 2.

Title 49 *Code of Federal Regulations* 213.233, "Track Inspections," requires an inspection frequency for class 4 track of twice weekly with at least one calendar day interval between inspections.[5] In addition, section 213.233(b) states, in part, the following with respect to a track inspection conducted by riding over the track in a vehicle:

> (2) Two inspectors in one vehicle may inspect up to four tracks at a time provided that the inspectors' visibility remains unobstructed by any cause and that each track being inspected is centered within 39 feet from the track upon which the inspectors are riding;
>
> (3) Each main track is actually traversed by the vehicle or inspected on foot at least once every two weeks, and each siding is actually traversed by the vehicle or inspected on foot at least once every month. On high density commuter railroad lines where track time does not permit an on track vehicle inspection, and where track centers are 15 foot or less, the requirements of this paragraph (b)(3) will not apply.

According to Metro-North track inspectors, the vast majority of track inspections were conducted from one of the two inside tracks (that is, main tracks 1 and 2). During those inspections, all four main tracks were inspected simultaneously by two track inspectors riding in a hi-rail vehicle. Metro-North track inspectors told NTSB investigators when they had an opportunity to inspect the outside tracks (that is, main tracks 3 and 4) while riding in a hi-rail inspection vehicle over those tracks, they had to rush in order to avoid impact to on-time train performance. This assertion was verified by the Metro-North Assistant Track Supervisor, who said the inspectors brought this issue to his attention. Another manager said that train density was increasing so much that it was difficult to schedule track maintenance. He said on-time train schedule performance took precedence.

[3] The hi-rail vehicle used on the New Haven Line is a two-door pickup truck that is equipped with hydraulic operated hi-rail wheels and a multichannel bandwidth radio for communication with varying departments.

[4] The rail joint was held in place by joint bars.

[5] Metro-North normally inspects this track three times each week either on foot or using a hi-rail vehicle. The track was inspected twice during the week of May 12, 2013.

At the NTSB's investigative hearing on November 7, 2013, the Metro-North Assistant Vice President of Maintenance of Way and Chief Engineer was asked when the last walking or hi-rail inspection was conducted by physically traversing main track 4 in the area of the derailment. He stated that, based on his review of records from January 2013 through May 17, 2013, he was unable to determine the last time main track 4 was physically walked or traversed by a hi-rail inspection vehicle.

The NTSB previously has expressed concern about the adequacy of simultaneous inspection of multiple tracks and the importance of physically riding over the inspected track. In its December 18, 2012, comments on the FRA Notice of Proposed Rulemaking, titled "Track Safety Standards; Improving Rail Integrity," the NTSB explained the basis for this concern as follows:

> When inspecting track from a typical hi-rail vehicle, an inspector can see the track structure in front from about 20 feet. In addition to operating the vehicle and looking in the direction of travel for track defects 20 feet in front, an inspector may be expected to inspect an adjacent track up to 30 feet to the side. Furthermore, part of the inspection may include the sound or feel of the track as the inspection vehicle rides over the track. These parts of the inspection are not performed if the inspector is inspecting [from] adjacent track. In addition, most defective track conditions occur after a period of gradual deterioration and are not observed during a single inspection cycle, although some conditions become visible to normal inspection when there is a rapid failure. The most important cause of track structure deterioration is rail traffic; the more severe the traffic conditions—measured by total tonnage, individual loads, car conditions, train handling, and speed—the greater the rate of deterioration will be. The NTSB believes that both gradual deterioration and rapid failures can create serious hazards, and the probability of detecting these hazards is substantially reduced when multiple tracks are being inspected simultaneously.

Postaccident Actions

On May 19, 2014, the NTSB issued the following recommendation to the FRA as a result of this accident:

(R-14-11)

> Revise the Track Safety Standards specified in Title 49 *Code of Federal Regulations* 213.233(b)(3), removing the exemption for high-density commuter railroads and requiring all railroads to comply with these requirements: (1) to traverse each main track by vehicle or inspect each main track on foot at least once every 2 weeks, and (2) to traverse and inspect each siding, either by a vehicle or on foot, at least once every month.

On May 19, 2014, the NTSB also issued the following recommendation to Metro-North:

(R-14-12)

> Revise your track inspection program to include requirements (1) to traverse each main track by vehicle or inspect each main track on foot at least once every 2 weeks, and (2) to traverse and inspect each siding, either by vehicle or on foot, at least once every month.[6]

After the accident, Metro-North initiated a number of specific actions related to the state of its track repair, one of which was the assessment of its system immediately following the accident in Bridgeport. Metro-North contracted the Transportation Technology Center, Inc. (TTCI), an internationally recognized research arm of the American Association of Railroads, for a comprehensive assessment of its track infrastructure and maintenance program. The TTCI provided a set of recommendations on improving Metro-North track inspection and maintenance. Metro-North provided the NTSB with an action plan on these recommendations that included better quality control of track inspections, using gage restraint measurement systems, increased use of track geometry vehicles, and moving to automated record keeping for track inspection data.

Probable Cause

The NTSB determined that the probable cause of the derailment was an undetected broken pair of compromise joint bars on the north rail of track 4 on the Metro-North Railroad New Haven subdivision at milepost 53.25 resulting from: (1) the lack of a comprehensive track maintenance program that prioritized the inspection findings to schedule proper corrective maintenance; (2) the regulatory exemption for high-density commuter railroads from the requirement to traverse the tracks they inspect; and (3) Metro-North's decisions to defer scheduled track maintenance.

For more details about this accident, visit www.ntsb.gov/investigations/dms.html and search for NTSB accident ID DCA13MR003.

[6] Safety Recommendations R-14-11 and -12 are currently classified "Open—Await Response."

Adopted: October 24, 2014

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The NTSB has authority to investigate and establish the facts, circumstances, and cause or probable cause of a railroad accident in which there is a fatality or substantial property damage, or that involves a passenger train. (49 U.S. Code § 1131 - *General authority*)

The NTSB does not assign fault or blame for an accident or incident; rather, as specified by NTSB regulation, "accident/incident investigations are fact-finding proceedings with no formal issues and no adverse parties . . . and are not conducted for the purpose of determining the rights or liabilities of any person." 49 *Code of Federal Regulations*, Section 831.4. Assignment of fault or legal liability is not relevant to the NTSB's statutory mission to improve transportation safety by investigating accidents and incidents and issuing safety recommendations. In addition, statutory language prohibits the admission into evidence or use of any part of an NTSB report related to an accident in a civil action for damages resulting from a matter mentioned in the report. 49 *United States Code*, Section 1154(b).