National Transportation Safety Board

Railroad Accident Brief

Metro-North Railroad Derailment

Accident No.:	DCA13FR009
Location:	Bronx, New York
Date:	July 18, 2013
Time:	8:29 p.m. eastern daylight time
Railroad:	CSX and Metro-North Railroads
Property damage:	$827,700
Injuries:	0
Fatalities:	0
Type of accident:	Derailment

The Accident

On July 18, 2013, at 8:29 p.m. eastern daylight time, northbound CSX Transportation (CSX) train Q70419, derailed on the Metro-North Railroad (Metro-North) Hudson Line at milepost (MP) 9.99 on main track 2.[1] The train consisted of 2 locomotives and 24 modified flat cars. Each flat car was loaded with 4 containers containing municipal refuse. The 11th through 20th cars derailed.

Northbound Metro-North train 781 was stopped on main track 1 at Marble Hill Station (MP 9.8) when the CSX train passed.[2] The Metro-North engineer reported seeing sparks and dust flying when the CSX train derailed. He also reported seeing no dragging equipment or anything unusual prior to seeing the sparks and dust.

There were no injuries. CSX and Metro-North estimated the damage at $827,700. The weather at the time of the accident was 91°F and clear. The National Weather Service had issued a heat advisory from July 14 to 18, 2014.

Brief Narrative

The crew, consisting of an engineer, student engineer, conductor, and conductor trainee, took charge of the CSX train at the CSX Oak Point Yard in The Bronx, New York, at 6:30 p.m. After entering Metro-North tracks, the train proceeded north on main track 4. The crew

[1] All times in this report are in eastern daylight time.

[2] Metro-North rules require employees to observe passing trains whenever possible for defects or unusual conditions.

encountered a stop signal at CP 10. The engineer said that he slowed the train using dynamic brakes and was almost to a stop when the signal changed to clear. The routing at CP 10 took the CSX train through a turnout (that is, a diverging switch) from main track 4 to main track 2. The engineer said that he increased the throttle in steps to full throttle, and when the maximum authorized speed of 15 mph was achieved, he reduced the throttle in steps to idle.[3] He told investigators that this was his usual technique – to get up to speed and then "drift" through the banked curve. Then, he again would gradually increase throttle as the train was slowed by the curves. As the speed reduced, the engineer began increasing the throttle in steps. At that time, he received a radio call from Metro-North train 781, which was stopped at Marble Hill Station on track 1, informing him that his train (CSX train) had derailed cars.

The CSX engineer said he immediately applied the full service air brake and shortly thereafter the train went into emergency braking. He said that he immediately made an emergency radio transmission. Upon making a walking inspection, the conductor determined that the 11th through the 20th cars had derailed on main track 2 and that derailed equipment was blocking main track 1. (See figure 1.)

Figure 1. Derailed cars in cut (left). Point of derailment area (right).

Track Image Recorders

Both CSX locomotives were equipped with forward-facing video recorders.[4] The video from the leading locomotive had insufficient detail for close track examination. The video from both the front and rear locomotives showed movement consistent with a slight dip (that is, a low spot in the track) to the west in the general vicinity of the point of derailment (POD). The video from the rear locomotive did not show any other unusual movements of the first car in the train.

[3] Event recorder data indicate that the train reached a speed of 19 mph before beginning to slow.
[4] The second locomotive was traveling backward so the video was facing the first car in the train.

Track

The POD was determined by a wheel flange mark on the inside base of the west (low) rail at MP 9.99 (72 feet 10 1/4 inches north of CP 10). (See figures 2 and 3.)

Figure 2. Marks on gage side of base of low rail at point of derailment highlighted by arrows.

Figure 3. Point of derailment showing a slight outward bow as compared with the straight yellow line.

In the vicinity of the POD, the tracks run parallel to the Harlem River and have a negligible grade. Track in this area was designated by Metro-North as Class 2 track.[5] Maximum train speeds were 30 mph for passenger trains and 15 mph for freight trains.

The track at the POD is continuous welded rail fastened on concrete ties with Pandrol low shoulder clips and supported by crushed trap rock ballast.[6] The crosstie spacing is 24 inches on center.

The concrete ties in the POD area were installed in 2000, and the track was last surfaced in 2004. Metro-North interviews revealed that the railroad's cyclic maintenance program for tie replacement was on a 6- to 7-year schedule, and surfacing was on a 3-year schedule. At the NTSB investigative hearing on November 7, 2013, Metro-North's Assistant Vice President and Chief Engineer stated that Metro-North was:

> … behind in several areas of our programs and tie cycles and surfacing are two of those areas, as are some of the other programs. I can't give you an answer as to how we got so far behind, but we're working towards getting back into phase.[7]

In the vicinity of the POD, investigators noted that the clip insulators on the field side of the rail had slipped out of place, so they were incorrectly positioned above the base of the rail on a number of ties. With the bottom of the insulator above the rail base, a gap is created allowing the rail to move further outward and thereby widening the gage by approximately 5/16 inch.

[5] FRA classifies track by number to indicate allowable train speeds and maintenance standards. Class 2 track allows passenger train speeds of 30 mph and freight train speeds of 25 mph. Metro-North further reduced allowable freight train speeds to 15 mph.

[6] Pandrol is a brand of track fasteners used on many railroads.

[7] Transcript of Hearing 11-6-13, p. 36.

Figure 4. Diagram showing proper installation of Pandrol insulators (shown in yellow) and clips (shown in red). The rail is shown in grey. (Source: Pandrol brochure)

Figure 5. Proper installation of a Pandrol clip and insulator.

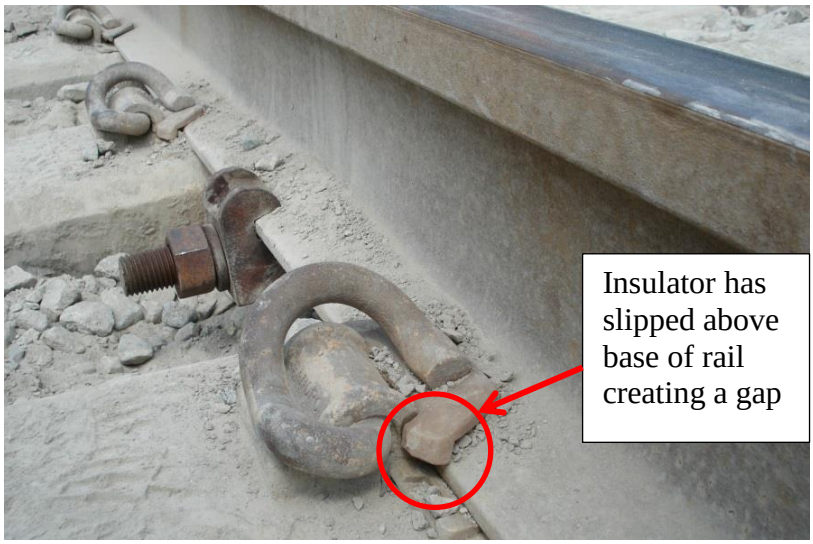

Figure 6. Insulator between Pandrol clip and rail base. Note that bottom portion of the insulator in the image in the foreground has slipped above base of rail on field side creating a gap.

Soil intrusion into the ballast (fouled ballast) was noted in the derailment area.[8] Fouled ballast occurs when inadequate drainage results in a buildup of water in the track substructure. Hydraulic action ("pumping") during train movements over the area results in fine soil particles rising to the surface and contaminating the ballast. In addition, the movement of the ties in the ballast can cause abrasion of the ties. The gray powdery substance that was observed throughout the track structure in the POD area appeared to be from concrete tie abrasion. Over time, pumping and fouled ballast conditions worsen and provide less structural support to the ties and track.

Satellite images from June 2010 (3 years before the derailment) showed the fouled ballast at the point of derailment, indicating fouled ballast at the POD was not a recent phenomenon.[9]

[8] The white material is a combination of ballast and concrete dust mixed with soil. The concrete dust is formed by the movement of the ties against the ballast as the track "pumps" during train movement.

[9] Google Earth screen shot dated June 17, 2010.

Figure 7. 2010 Satellite image showing fouled ballast at the POD (that is, the white areas inside red circles).

Figure 8. 2011 Satellite image showing fouled ballast at POD.

A similar image about 1 year later shows the POD fouled ballast more clearly.[10]

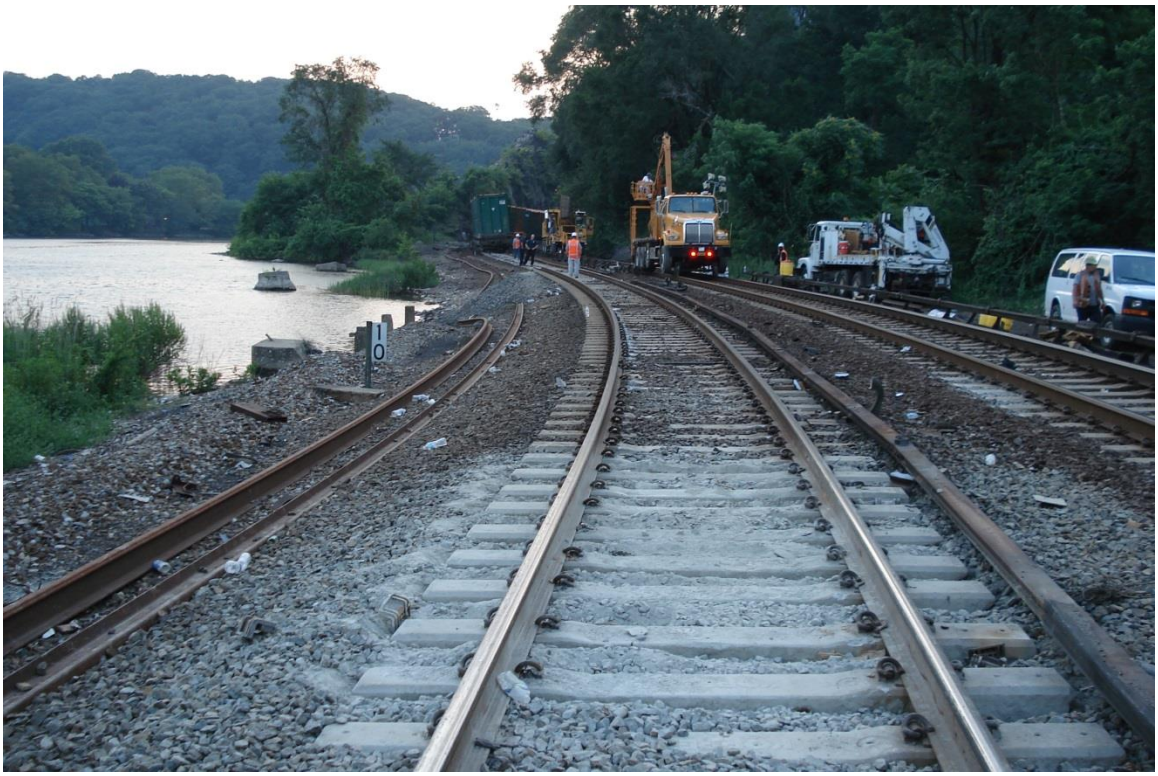

Figure 9: Close up of fouled ballast in POD area.

Following the train derailment in Bridgeport, Connecticut, on May 17, 2013, Metro-North hired the Transportation Technology Center, Inc. (TTCI) to evaluate the Metro-North track maintenance program. As part of that evaluation, TTCI conducted a survey of track areas with poor drainage. The survey identified 654 locations on the Metro-North system with poor drainage and fouled ballast, including the accident location.

The Federal Railroad Administration (FRA) DOTX 220 track geometry car was used to inspect the area of the derailment on June 4, 2013. The inspection report disclosed no exceptions to FRA track geometry regulatory standards. A review of the strip chart from the inspection revealed a profile measurement of 2 inches (that is, a dip) in both rails in the derailment area and a gage of 57.81 inches; both measurements were within tolerance.[11] The maximum allowable profile measurement is 2 3/4 inches in Class 2 and the maximum allowable gage for Class 2 is 57 3/4 inches.

[10] Google Earth screen shot dated June 2, 2011.

[11] Track geometry car measurements are in decimal form while track standards are listed in fractions. The track geometry car equipment uses laser scanning at 1-foot intervals, which sometimes spike and register false positives. For the equipment to highlight a gage defect, the gage must be .1 inch or greater over tolerance or exceed tolerance for several feet.

Metro-North conducted a walking inspection of the derailment area on July 18, 2013, prior to the derailment. The inspection report did not include any reportable track defects in the POD area.[12] However, consistent with the fouled ballast and inadequate drainage discussed above, the inspection report noted, "MP11.4, track 1 has a mud spot, MP 10.1, track 2 has a mud spot and a 1/2-inch profile deviation, MP 10.2, track 2 two broken ties and surfacing needed." The inspection record did not note any exceptions at MP 9.99 on track number 2.

Track panels from the derailment site were preserved and later disassembled at Metro-North High Bridge Yard. Wear in the rail seat area was noted on many of these ties along with a worn trough on the field side of the rail seat. (See figure 10.) This wear was indicative of the rail canting outward.

Figure 10. Groove worn into field side of rail seat.

Center cracking was evident on a number of ties. (See figure 11.) Center cracking on concrete ties is an indication that the ties are center bound, meaning that there is inadequate support at the ends of the ties and that they can flex or bow under loads. When ties bow, the track gage increases because the rails cant outward.

[12] Metro-North used the FRA track standards as the criteria for reportable defects.

Figure 11. Cracks at centers of ties at POD. (Gage rod was installed after the derailment.)

The cross section of the ties was reduced by abrasion on the bottom of the ties, and the reduced cross section was more pronounced at the ends of ties at the inside of the curve. Steel tensioning strands were exposed on the ends of many ties. (See figure 12.) More pronounced loss of cross section at the ends of ties indicates more movement and abrasion against the ballast and is another indication of less support at the ends of ties than in the center.

Figure 12. Tie from POD area (left) with reduced cross section and exposed tension strands and unused exemplar tie (right).

The investigation determined that the following were not factors in the accident: the signal system; the train mechanical condition; the actions of the CSX train crew in handling the train; the actions of the Metro-North rail traffic controller; and the weight and loading of the containers.

Metro-North Postaccident Actions

As mentioned above, following the Bridgeport derailment, Metro-North contracted with TTCI to conduct a comprehensive review of the entire track maintenance program. TTCI produced a series of reports in early 2014, which included specific recommendations to improve the Metro-North track maintenance program. Metro-North provided an action plan.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was excessive track gage due to a combination of fouled ballast, deteriorated concrete ties, and profile deviations resulting from Metro-North's decision to defer scheduled track maintenance.

For more details about this accident, visit www.ntsb.gov/investigations/dms.html and search for NTSB accident ID DCA13FR009.

Adopted: October 24, 2014

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

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