National Transportation Safety Board

CSX train Derailment on Metro-North Railroad
July 18, 2013
Bronx, New York
DCA-13-FR-009

Factual Report

Synopsis

On July 18, 2013, at 08:29 p.m.[1], northbound CSXT train Q70419, derailed at milepost 9.99 on main track number 2 of the Metro-North Railroad Hudson Line. The train consisted of 2 locomotives and 24 modified flat cars. Each flat car carried 4 containers loaded with municipal refuse. The train departed CSXT Oak Point Yard and was routed onto the Metro-North Railroad at Control Point (CP) 8.0. The 11th through 20th cars derailed at a point 72 feet 10 ¼ inches north of CP 10.

The engineer of northbound Metro-North train 781 that was stopped at Marble Hill station (MP 9.8) reported seeing sparks and dust flying when the CSXT train derailed after the CSXT train had passed his train. There were no injuries. Damage to rolling stock was estimated by CSXT at $37,700 and damage to track was estimated by Metro-North at $790,000. The weather at the time of the accident was reported as 91°F and clear.

[1] All times are eastern daylight time

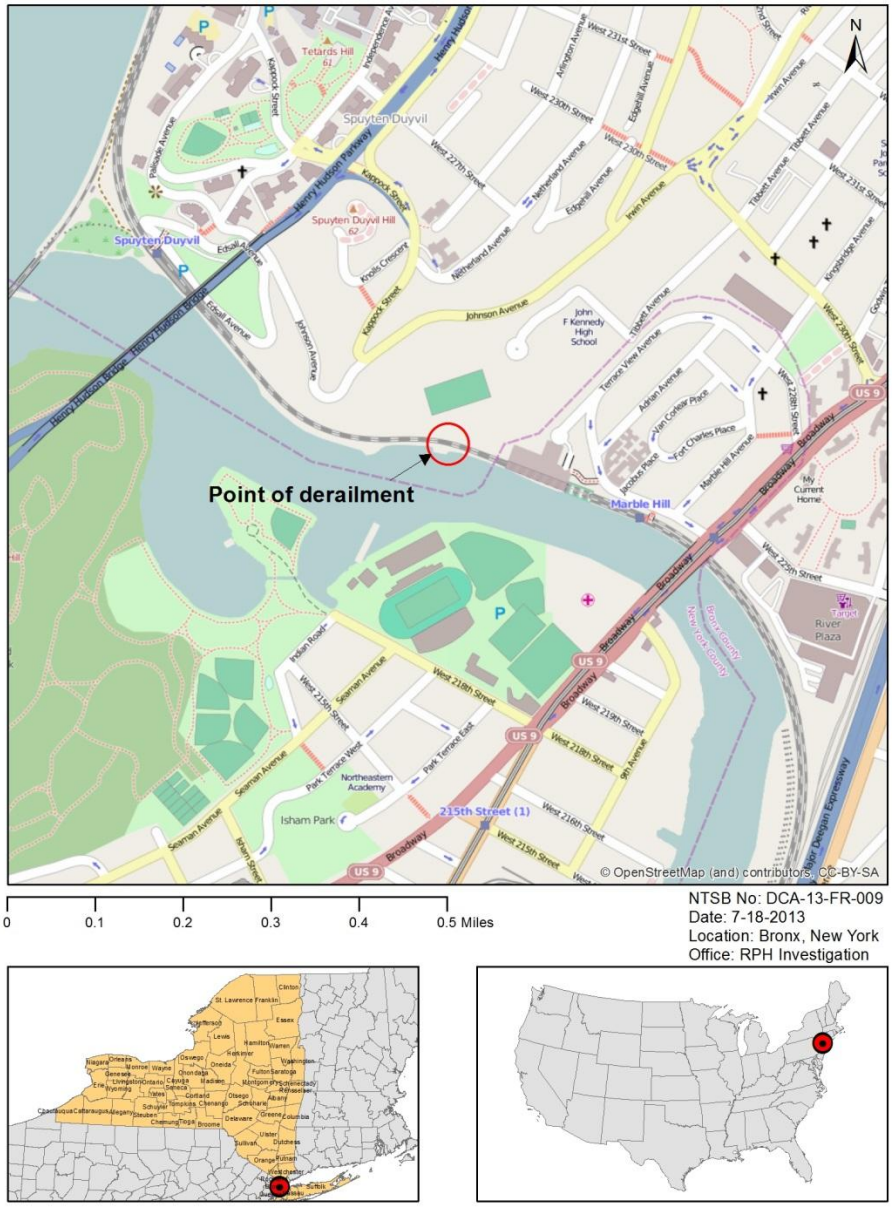

Figure 1: Maps showing accident location in the Bronx, NY

Brief Narrative

The crew (engineer, student engineer, conductor and conductor trainee) of the CSXT Q70419 took charge of their train in CSXT Oak Point Yard (Bronx, NY), at 6:30 p.m. They coupled their locomotives to 5 flat cars loaded with refuse containers. The 5 cars had previously

been inspected and tested with yard air. The crew completed a Class 3[2] air brake and departed. They stopped at a Waste Management facility to pick up 19 additional flat cars loaded with refuse containers which they coupled to the 5 cars already in their train. The 19 cars had previously been inspected and tested with yard air. The crew did not conduct a Class 3 air brake test before departing. The event recorder shows that the engineer did conduct a running air brake test shortly after departing. The CSXT train now had two locomotives on the head end and 24 flat cars with loaded municipal refuse containers. The crew indicated that they did not experience any problems with the train before the derailment.

The CSXT Q70419 entered Metro-North tracks at CP 8 and proceeded north on main track 4. As the train neared CP 10, the crew first encountered an approach, and then a stop signal at CP 10. The engineer said 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 CSXT Q70419 through a turnout from main track 4 to main track 2. The engineer said he increased the throttle in steps to full throttle (position 8), and when the maximum authorized speed of 15 mph was achieved he reduced the throttle in steps to idle. He told investigators that this was his usual technique – to get up to speed and then "drift" through the curve, then to gradually increase throttle as the train was slowed by the curves. As the speed reduced the engineer began increasing the throttle in steps to throttle 3. At this time he received a radio call from Metro-North train 781 that was stopped at Marble Hill Station indicating that the CSXT Q70419 had derailed cars. The engineer said he immediately applied full service air brake and shortly thereafter, the train went into emergency braking. He said 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 debris was blocking main track 1.

[2] See 49 CFR Part 232.211

Figure 2: Derailed cars in cut (left). Point of derailment area (right).

Train Symbol	Q70419-19
Operational ID	CSX 8846
Locomotives	CSX 8846 and 8833
Loads	24
Empties	0
Trailing tonnage	2536 tons
Train length	2298 feet

Figure 3: CSXT Train Information

Toxicological Testing

The CSXT crew and the Metro-North Rail Traffic Controller (RTC) were not required to undergo post-accident drug/alcohol testing.

Post-accident drug and alcohol testing is required of any safety sensitive employee involved in a railroad accident meeting criteria listed in 49 Code of Federal Regulations Part 219 unless a railroad official:

> …can immediately determine, on the basis of specific information, that the employee had no role in the cause(s) or severity of the accident/incident.[3]

[3] 49 CFR 219.203(a)(3)

Metro-North officials made an assessment and determined that the CSXT crew and the Metro-North RTC were not required to be tested.

Operations

The Hudson Line begins at MP 0.00 Grand Central Terminal in New York City, NY and runs to MP 75.5, north of Poughkeepsie, NY. The main tracks are geographically oriented in a south to north direction from Grand Central Terminal to Poughkeepsie in the northward direction with the milepost numbering increasing in the northward direction.

Approximately 106 northbound and 99 southbound Metro-North trains operate over the accident area on a daily basis. In addition, 4 to 6 CSXT freight trains operate over this area daily. The estimated total annual tonnage over each track is approximately 20 million gross tons. The load limit for individual freight cars between CP 8 and Poughkeepsie is 286,000 pounds.

CSXT freight train movements were governed and authorized by signal indication and cab signals on the Metro-North. The territory was Centralized Traffic Controlled (CTC) with cab signals. The two main tracks at the accident site were signaled for train movements in both directions. The Metro-North RTC was stationed at the Operations Control Center (OCC) in Grand Central Terminal, New York, NY. The RTC could set routes for trains at various control points along the railroad.

The CSXT crews operating on Metro-North were governed by the Metro-North Railroad Operating Rules, effective February 27, 2011. The territory was designated as the Metro-North Railroad Hudson Line. At the time of the accident, the current timetable was Time Table #1. The current General Order was number 104 effective April 14, 2013.

CSXT crews were further governed by CSXT Airbrake Train Handling & Equipment Handling rules effective April 1, 2010.

The personnel records of the CSXT engineer and conductor indicated that they were qualified to operate CSXT trains on Metro-North tracks.

Operational Plan

The Metro-North RTC said that he intended to operate CSXT Q70419 from main track 4 to main track 2 at CP 10 and then back to main track 4 at CP 11. He intended to operate Metro-North passenger train 781 from the Marble Hill platform on main track 2 to main track 1 at CP 10. This would allow both trains to keep moving. However, the conductor on Metro-North train 781 had been injured by a dog bite and that train was being held at Marble Hill. The CSXT train would have operated on Metro-North track to Poughkeepsie where it would have entered CSX tracks to Selkirk, NY, then proceeded southbound to its destination of Waverly, Virginia.

Event Recorders

The event recorder data was generally consistent with information provided by the CSXT engineer – save for the missing Class 3 air brake test when the 19-car pick up was added to the train at the Waste Management facility. The event recorder data did show that the engineer made a running air brake test before entering Metro-North tracks and also show that the air brakes were used to stop the train once prior to the derailment.

After departing CP-10, the event recorder data indicate that the train reached a speed of 19 mph before gradually reducing in speed to 11 mph at the point where emergency brakes activated. The event recorder data indicates that upon departing from CP-10, the CSXT engineer increased the throttle from idle to position 8 in steps over a 50 second time period. When the train speed reached 15 mph, the engineer reduced the throttle to idle in steps over a 44 second time period. Train speed had increased to 19 mph. The train remained in idle for 37 seconds and speed decreased to 17 mph. As speed continued to decrease, the engineer increased from idle to throttle position 3 over a 19 second time period. Two seconds later, with train speed at 11 mph, the brake pipe pressure dropped to zero.

Event recorder tabular data is attached to this report as Attachment 1. The full event recorder factual report is entered as a separate docket item.

Track Image Recorders

Forward facing video recorders were installed on both CSXT locomotives[4]. The video from the leading locomotive did not show sufficient detail to closely examine the track. The video from both the front and rear locomotives showed a slight dip (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.

Mechanical Equipment:

All the cars in the train were either owned or leased by Waste Management, Inc. The flat cars varied from 89-91 ft. in length and were modified to accommodate 4 municipal refuse containers per car. Each container was 12 feet high, 8 feet wide and 20 feet long. The cars were in dedicated service with the containers loaded in New York City and then emptied at a land fill in Waverly, Virginia. The cars and empty containers then ran back to New York City.

The CSXT train cars and locomotives were inspected for any indication of dragging equipment or other defective conditions that may have played a role in the derailment. None were found.

Cars in positions 8 – 13 (from behind the locomotives) were positioned for further examination in the CSXT shops at Selkirk, NY.

Car Number	Position behind locomotives	Sequence in Derailment
USWX 40004	8	Underailed
USWX 40112	9	Underailed
USWX 40113	10	Underailed
USWX 638345	11	1st car to derail
USWX 638391	12	2nd car to derail
USWX 40239	13	3rd car to derail

Figure 4: Cars inspected at Selkirk, NY

The parties witnessed a detailed tear down of each car that included inspection and measurement of trucks, wheels, axles, couplers, side bearings and draft gear. Each car body was

[4] The second locomotive was traveling backwards so the video was facing the 1st car in the train.

also lifted off the trucks to examine the condition of the bearing surface of each truck, bolster and car center pin assembly. No defective conditions were noted during the inspections. Inspection sheets for each of the 6 cars are included as Attachment 2.

Lading: (See Factual Report Amendment)

Information originally in this section has been superseded by a factual addendum

New York Weather Conditions on July 18, 2013

Synoptic conditions – The National Weather Service (NWS) Surface Analysis Chart for 2000 EDT on July 18, 2013 depicted a weak trough of low pressure moving across the New York area but with a relatively weak pressure gradient, which resulted in west to south winds of 10 knots or less, clear skies, and temperature in the 90's degrees Fahrenheit (F).

Observations – The closest weather reporting locations to the accident site were from Teterboro Airport (KTEB) located approximately 7 miles west and La Guardia Airport (KLGA) 7 miles south. The following conditions were reported at the approximate time of the derailment:

Teterboro Airport weather at 2051 EDT, wind from the southwest at 5 knots, visibility 10 statute miles, skies clear below 12,000 feet, temperature 91° F (33° C), dew point 70° F (21° C), altimeter 29.96 inches of mercury. The relative humidity at the time was 49%, with a heat index of 97° F which places it in the extreme caution range.

LaGuardia Weather at 2051 EDT, wind from the west-southwest at 8 knots, visibility 10 statute miles, a few clouds at 7,000 feet, scattered clouds at 25,000 feet, temperature 95° F (35° C), dew point 66° F(19°C), altimeter 29.96 inches of mercury. Remarks: sea level pressure 1014.7-millibars, temperature 35.0° C, dew point 18.9° C. The relative humidity was calculated at 40%, and a heat index of 98° F.

Past 5 day conditions:

Date	KLGA Weather	KTEB Weather
July 18	High 97F, Low 82F	High 98F, Low 78F
July 17	High 95F, Low 81F	High 97F, Low 78F
July 16	High 93F, Low 80F	High 93F, Low 75F
July 15	High 93F, Low 80F	High 93F, Low 75F
July 14	High 93F, Low 72F	High 91F, Low 73F

No significant rain was reported during the period from July 14 through July 18, 2013.

Forecast/Warnings – The NWS had a Heat Advisory and Excessive heat Warning in effect from July 14 through July 18.

Track:

The point of derailment (POD) was determined by a wheel flange mark on the inside base of the west rail at MP 9.99 (72 feet 10 ¼ inches north of CP 10).

Figure 6: Point of Derailment (POD) showing south home signal for CP 10 in background (Note: gage rod was installed after the derailment)

Figure 7: Marks on gage side of base of low rail at POD

Figure 8: View of POD area

The Metro-North tracks in this area narrow from 4 main tracks at Marble Hill Station to 2 main tracks at the derailment location. The tracks run parallel to the Harlem River with a negligible grade. Track charts indicated that the point of derailment was at the spiral transitioning into a 7° left hand curve with a designed super-elevation of 1-7/8 inches. Train speeds were set by Metro-North at 30 mph for passenger trains and 15 mph for freight trains.

The track at the POD is comprised of continuous welded rail (CWR) fastened on concrete crossties[5] with Pandrol low shoulder E clips and supported by crushed trap rock ballast. The crosstie spacing is 24 inches on center. The CWR through the curve was a mixture of 140 and 136 pound rail.

The concrete ties and rail were installed in 1993 and the track was last surfaced in 2004. Metro-North interviews revealed that the Metro-North cyclic maintenance program for surfacing was on a 3-year schedule and tie replacement was on a 6 to 7-year schedule. Metro-North's Assistant Vice President – Chief Engineer explained at the NTSB investigative hearing into the Bridgeport/Westhaven accidents 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.[6]

In the vicinity of the POD, it was noted that the rail base had slipped under the insulator clips on the inside curve rail which added approximately 5/16 inch to the gage. The high side rail had a mixture of the same insulator clips and some that were modified with metal inserts.

[5] The concrete cross ties were manufactured by Koppers (KSA).
[6] Transcript of Hearing 11-6-13, p. 36

Figure 9: Insulator between pandrol clip and rail base of the type with metal insert. Note that insulator has slipped above base of rail on field side.

Figure 10: Insulator between pandrol clip and rail base of the type without metal insert. Note that insulator has slipped above base of rail on field side.

Soil intrusion into the ballast (fouled ballast) was noted in the derailment area. Satellite images[7] from June 2010 (4 years before the derailment) were examined and showed the fouled ballast at the point of derailment.

[7] Google Earth Screen Shot dated June 17, 2010.

Figure 11: Satellite image from 2010 showing fouled ballast at POD

Fouled ballast occurs when inadequate drainage results in a buildup of water in the track sub-structure. 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 powdery substance that was observed throughout the track structure in the POD area appeared to be from concrete tie abrasion and ballast stone abrasion. Samples were sent to the NTSB laboratory for further analysis and the results will be entered as a separate docket item.

Following the May 17, 2013 Bridgeport, CT derailment, 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. Metro-North provided NTSB with the results of the survey (Attachment 4). The survey identified 654 locations on the Metro-North system with poor drainage.

FRA's DOTX 220 track geometry car inspected the area of the derailment on June 04, 2013. The inspection report disclosed no exceptions to FRA track geometry regulatory standards in the vicinity of the POD. A review of the strip chart revealed that there was a profile measurement of 2 inches in both rails in the derailment area and a gage of 57 5/8 inches. The

maximum allowable deviation for profile is 2 ¾" in Class 2 and the maximum allowable gage for Class 2 is 57 ¾".

Metro-North track inspection records were reviewed. They showed that the last inspection was conducted on foot on July 18, 2013 earlier in the day of the derailment. The inspection report did not indicate any reportable[8] track defects in the POD area. However, the inspection report surface comment section states in part: "MP11.4, track1 has a mud spot, MP 10.1, track 2 has a mud spot and a ½ 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.

Post-accident track measurements (unloaded) were made starting at the POD. Measurements were taken at 10 stations located at 15.5 ft. intervals south of the POD (the track north of the POD was too disturbed by derailment damage to yield relevant measurements). Measurements are shown below:

Station	Gage	Elevation
S-10	57	1/2
S-9	56 11/16	1/2
S-8	56 3/4	13/16
S-7	56 3/4	1
S-6	57	1
S-5	57	1
S-4	56 3/4	1 9/16
S-3	56 3/4	1 5/8
S-2	57	1 7/8
S-1	57 1/8	1 7/8
Zero	58 1/4	1 7/8

Figure 12: Post-accident track measurements

Investigators also made track deflection measurements under the plow of a GP 35 locomotive.[9] The POD was between ties N1 and S1.

[8] Metro-North used the FRA track standards as the criteria for reportable defects.
[9] These locomotives weight approximately 135 tons.

Tie	LOW SIDE	HIGH SIDE
N2	1/16	2/16
N1	1/16	4/16
S1	3/16	6/16
S2	3/16	6/16
S3	5/16	5/16
S4	4/16	5/16
S5	3/16	2/16
S6	1/16	1/16

Figure 13: Maximum measured deflections under load

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.

Figure 14: Groove worn into field side of rail seat

Center cracking was evident on a number of ties and the cross section of the ties was reduced by abrasion on the bottom of the ties.

Figure 15: Cracks at centers of ties at POD (Note: gage rod was installed after the derailment)

Reduced cross section was more pronounced at the ends of ties. Steel tensioning strands were exposed on the ends of many ties.

Figure 16: Tie from POD area with reduced cross-section and exposed tension strands

The Volpe Transportation Systems Center used track and car data to create wheel-rail interaction simulations. The Volpe report will be entered as a separate item in the docket.

Several intact ties from the POD area along with one exemplar "new" condition tie were set aside for lab testing. The lab test report will be entered as a separate item in the docket.

Parties Representatives:

Joe Kennedy, Chief Inspector Federal Railroad Administration	Jeff Machnik, Terminal Manager CSX Transportation
Anne Kirsch, Chief Safety Officer Metro North RR	Chris Silvera, Secretary-Treasurer Int'l Brotherhood of Teamsters Local 808
Felix Maestri, Local Chairman American Railway and Airline Supervisors Association	John Sullivan, Senior District Manager Waste Management, Inc.
C. William Hahl, President Diversified Mechanical Services	Scott Craig, General Manager KSA (Koppers)

Attachments to Factual Report

Attachment 1: Event Recorder Tabular Data from CSX Train

Attachment 2: Inspection sheets from Selkirk, NY Examination

Attachment 3: FRA Inspection of Waste Management Loading Facilities

Attachment 4: TTCI Inventory of Poor Drainage Areas on Metro-North

-- END of REPORT –