



National Transportation Safety Board
Railroad Accident Brief
CSX Transportation Freight Train Derailment and
Bridge Collapse
Alexandria, Virginia
May 19, 2018

The Derailment

On May 19, 2018, at 7:02 a.m. local time, southbound CSX Transportation (CSX) freight train X41518 derailed near milepost (MP) 102.9 as it approached a bridge overpass in Alexandria, Virginia.¹ The train had been traveling on main track one of the RF&P subdivision.² As a result of the derailment, the CSX bridge supporting main track one was extensively damaged and collapsed at the approaching abutment wall. The bridge structure and 8 of the 31 derailed railcars fell upon the tracks below, owned by Norfolk Southern Railways (NS). (See figure 1.) The CSX bridge for main tracks two and three was not involved and remained in service throughout the investigation.³

¹ All times in this report are eastern daylight time unless otherwise noted.

² The RF&P subdivision was named for the former Richmond, Fredericksburg, and Potomac railroad, to which this section of track once belonged.

³ Additional information about this accident investigation can be found in the public docket for this accident (NTSB RRD18MR007) by accessing the [Accident Dockets](http://www.nts.gov/AccidentDockets) link for the Docket Management System at www.nts.gov. For more information on our safety recommendations, see the [Safety Recommendation Database](http://www.nts.gov/SafetyRecommendationDatabase) at www.nts.gov.

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Figure 1. The damaged bridge. The blue arrow indicates the direction of travel on the CSX track and the yellow arrow indicates the NS tracks.

CSX train X41518 consisted of three locomotives at the head end, 91 loaded railcars and 76 empty railcars. It was 9,910 feet in length and weighed 14,394 tons. The train was classified as a key train with mixed commodities.⁴ Of the 31 derailed railcars, 25 railcars (in positions 42 through 66) derailed near MP 102.9, the point of derailment (POD). A secondary derailment of six railcars (in positions 89 through 94) occurred at MP 103.2. The train crew was uninjured, and no hazardous materials were released. CSX estimated damages to be about \$6.4 million. There was light rain at the time of the derailment and the temperature was 72°F. A severe thunderstorm warning had been in effect for the area until about 4 hours before the time of the derailment. About 5.5 inches of rain fell in the area during the 10-day period prior to the derailment.

Track Description

The RF&P subdivision has four passing sidings and consists of 87.0 miles of double main track and 18.1 miles of triple main track between MP CFP 5.0 and MP CFP 110.1.⁵ The subdivision's average daily train count is about 65. According to CSX documentation, the 2017 total tonnage figure for main track one was about 45 million gross tons.

CSX inspects and maintains the main tracks on this portion of the RF&P Subdivision to Federal Railroad Administration (FRA) Track Safety Standards (TSS) for Class 4 track, which allow for a maximum operating speed of 60 mph for freight trains and 80 mph for passenger trains.

⁴ *Key trains* are subject to speed restrictions and other operating criteria and includes any train with 20 railcar loads or intermodal portable tank loads of any combination of hazardous material.

⁵ Most CSX railroad lines are given lettered prefixes before milepost numbers. In this case, the "CFP" identifies these tracks as the former Richmond, Fredericksburg and Potomac Railroad lines.

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CSX allows freight trains to operate at 60 mph. CSX allows Amtrak (National Railroad Passenger Corporation) and the Virginia Railway Express (VRE) to operate passenger trains over this subdivision at speeds up to 70 mph. Amtrak operates 21 passenger trains (11 southbound and 10 northbound) over this subdivision 7 days a week, while VRE operates 16 passenger trains (8 southbound and 8 northbound) over this subdivision 5 days a week.

Point of Derailment

The investigation revealed an area in a curve at MP 102.9 where the subgrade fill subsided from the track structure on main track one, about 500 feet before the bridge spanning the NS tracks.⁶ Upon their arrival on scene, CSX personnel discovered that the subgrade fill and track ballast had subsided for about 26 feet in length, and at a depth of about 18 inches below the top surface of the cross-ties. Figure 2 shows the POD, circled in red, and the subgrade fill failure. Main track one is at the top, main track two is in the middle, and main track three is at the bottom of the figure.

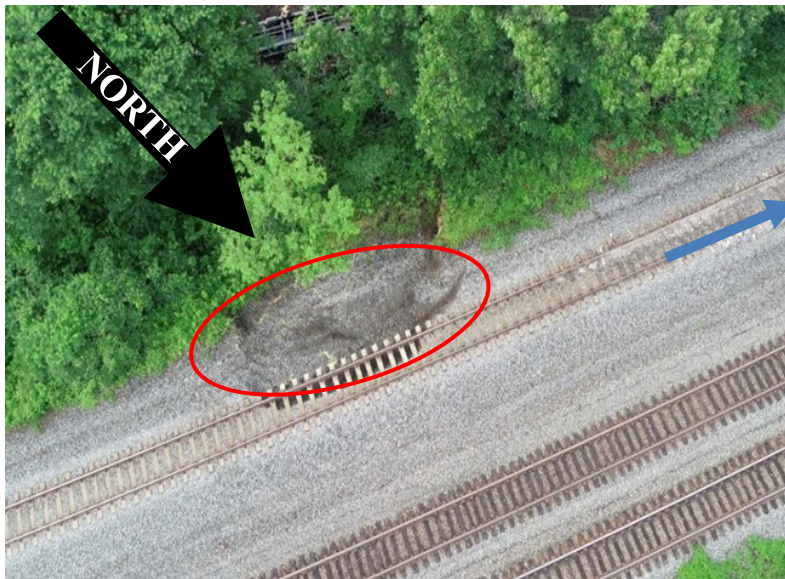


Figure 2. The POD location and the subgrade fill failure indicated with the red circle. The blue arrow indicates the direction of train travel.

NTSB investigators identified a flange mark, consistent with a departure from the normal wheel rail interface, traversing the top of the high rail at MP CFP 102.9. At this location there was an irregular cross-level deviation between the high and low rail due to subgrade fill failure.⁷ (See figure 3.) The resulting cross-level deviation was enough to allow a wheel climb derailment.

⁶ (a) *Subgrade* is the natural materials, gravel, or crushed rock, usually inferior to ballast or sub-ballast, placed in fills or at the bottom of cuts that lie directly below the sub-ballast. (b) *Fill* is subgrade material, such as soil and rock, that is used to establish the grade on which the track structure is built. (c) *Subsided* means railroad ballast that has sunk or moved away to a low or lower level beneath track rails and ties.

⁷ *High rail* is the outer or elevated rail of a curved track. *Low rail* is the inner rail of a curve which is maintained at grade while the opposite or outer rail is elevated.

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Figure 3. High rail with the flange mark circled in red.

Circumstances Prior to the Derailment

The day before the derailment, a CSX track inspector began an inspection that would have included the POD. However, the track inspector was instructed at 9:38 a.m. to go to the south end of the territory to inspect track 24 miles away near Neabsco, Virginia, because of a flash flood warning.

Geotechnical Data Report

The day after the derailment, CSX contracted with a geotechnical and environmental firm to perform borings in the area where the subgrade fill failed and the derailment occurred. The purposes of the borings were to: (1) perform slope stability analysis representative of the slide, and (2) provide slide repair recommendations and retaining wall alternatives. The contractor retrieved six borings from locations along both ends of the subgrade fill-failure area and beyond, along the track in either direction, and used a computer program to analyze them. The analysis showed [summarized]:

- The subgrade fill in the failure area was composed of relatively weak and wet soil.
- There was a concentration of water in a ballast pocket which saturated the slope in the failure area.

These findings were consistent with the on-scene observations of NTSB investigators. The weak and saturated soil, combined with the heavy rains that impacted the area, caused the subgrade fill to subside in the area of the POD.

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Subgrade Fill Conditions on the RF&P Subdivision

NTSB investigators requested an historical perspective regarding subgrade fill conditions on the RF&P subdivision. The CSX response stated:⁸

CSX is unaware of any other sudden fill failure on the RF&P since CSX acquired it, except for the most recent storm events. Two events that occurred earlier this year on the south end of the RF&P could be categorized as a slope failure (water was running at the toe of the slope) but to a much lesser extent.⁹ There have been numerous washout events over the last 20 years on the RF&P, including some the week of the derailment. There are also a couple of locations that require regular maintenance for surface and the time between required action for those locations is like the area at Alexandria, but those areas have never progressed to anything beyond routine maintenance.¹⁰

Track Inspection Records

NTSB investigators reviewed a CSX track geometry survey report that was conducted on the RF&P subdivision 12 days prior to the derailment. They found no conditions that exceeded FRA minimum safety standard thresholds near the POD location. In addition, the NTSB investigators reviewed a CSX internal rail testing report for the RF&P subdivision dated February 1, 2018, and found no documented condition that could have contributed to the derailment.

FRA regulations found in Title 49 *Code of Federal Regulations (CFR)* Part 213 require that a rail carrier's track inspection records be prepared and signed on the day of the inspection to comply with the FRA TSS. FRA track inspection records are required to reflect actual field conditions and deviations from the FRA TSS. Since CSX operated at FRA Class 4 speeds in the derailment area, CSX personnel were required to inspect the main track at least twice per calendar week with at least 1 calendar day interval between inspections.

Investigators reviewed CSX track inspection records from April 1, 2018, to May 20, 2018, and found no documented conditions that could have contributed to the derailment; no defects were recorded for the area around the POD. Investigators further noted that CSX track inspectors had conducted inspections at the FRA-required frequency, noting deviations from minimum safety standards, as required.

CSX provided the track disturbance report dated August 30, 2017.¹¹ The reports show that the derailment location on main track one was surfaced between CFP 102.8 and CFP 102.9. A

⁸ E-mail from CSX to NTSB investigator, August 26, 2018.

⁹ The slope failures noted by the railroad are also subgrade fill failures, but of a smaller magnitude.

¹⁰ *Track surfacing* refers to a railroad maintenance operation to raise the track structure and obtain desired track geometry. This work is primarily accomplished using specialized railroad work equipment.

¹¹ A *track disturbance report* is a document that shows the disturbance to a section of track and the corrective actions taken to resolve the issue.

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prior track disturbance report dated April 6, 2017, shows that main track 1 was surfaced between CFP 101.7 and CFP 109.0.

These records were reviewed to gain an understanding of the amount of track surfacing that was required to maintain the track geometry in the derailment curve. The fill degradation in the derailment area was not occurring at a pace that required an unusual amount of surfacing work to maintain track geometry.

NTSB investigators reviewed FRA track inspection records dated back to December 2017 and found no conditions documented that could have contributed to the derailment. FRA recorded no defects at MP 102.9.

A review of CSX's flash flood warning data revealed that no flash flood warnings were issued for the RF&P subdivision after 9:28 a.m. on May 18, 2018, 1 day prior to the derailment. NTSB investigators determined that CSX engineering department employees responded appropriately to the weather reports that were received.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the CSX Transportation train derailment and subsequent bridge collapse on May 19, 2018, was a subgrade fill failure of the track structure that displaced a large area of ballast under the low rail of the track near milepost CFP 102.9, resulting in a cross-level deviation of the track significant enough to allow a wheel climb derailment.

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For more details about this accident, visit www.nts.gov/investigations/dms.html and search for NTSB accident identification number RRD18MR007.

Date: April 1, 2020

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 significant injury to the environment. (49 U.S. Code, Section 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.” Title 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 U.S. Code, Section 1154(b).
