

**NATIONAL TRANSPORTATION SAFETY BOARD**

**Office of Railroad, Pipeline and Hazardous Materials Investigations  
Washington, DC**

**TRACK AND ENGINEERING FACTUAL REPORT**

**RRD18MR007**

**CSX Railroad, Derailment and Partial Bridge Collapse**

**Alexandria, VA  
May 19, 2018**

## **Accident**

NTSB Accident Number: RRD18MR007  
Date of Accident: May 20, 2018  
Time of Accident: 7:02 a.m. (EDT)  
Railroad Owner: CSXT  
Train Operator: CSXT  
Type of Train and No: X41518 (Mixed Freight/Hazmat)  
Crew Members: 1 Engineer, 1 Conductor  
Location of Accident: Alexandria, VA

## **Track Group**

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Federal Railroad Administration—Region 2  
Railroad Safety Inspector (Track)

Mr. David “Randy” Daniels  
CSXT  
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## **Accident Summary**

For a summary of this accident, refer to the *Accident Summary* report within this docket, RRD18MR007.

## **Track Description**

This portion of the CSXT, the RF&P subdivision, consists of 87.0 miles of double main track and 18.1 miles of triple main track between milepost CFP 5.0 and milepost CFP110.1, the subdivision has four passing sidings. The subdivision's average daily train count is about 65. According to CSX documentation, the 2017 total tonnage figure for the subject track was about 45 million gross tons.

Traveling on main track No.1, the southbound train traversed an ascending grade ranging from 0.08% to 0.80% beginning at milepost CFP 104 (bottom of grade) to milepost CFP102.0 (train resting location). From milepost CFP104.0 to the point of derailment (POD) at CFP 102.9, the train was on an ascending grade of between 0.08% and 0.80%. At the point of derailment, the train was traversing a curve that averaged 2-degrees of curvature, with 4 average inches of super-elevation (outer rail of curve elevated above the inner rail of curve).

CSX inspects and maintains the main track on this portion of the RF&P Subdivision to Federal Railroad Administration (FRA) Track Safety Standards (TSS) for Class 4 track, which allows for a maximum operating speed of 60 mph for freight trains and 80 mph for passenger trains. CSX allows freight trains to operate at 60 mph and passenger trains to operate at 70 mph. Amtrak operates 21 passenger trains (11 southbound and 10 northbound) over this subdivision 7

days a week. The Virginia Railway Express (VRE) operates 16 passenger trains (8 southbound and 8 northbound) over this subdivision 5 days a week.

No.1 track was constructed of concrete crossties that measured 8.5-inches by 10.5-inches by 8-feet 6-inches long, spaced 24 inches on center (nominal). The rails were fastened to the crossties using resilient/elastic fasteners on the gage and field sides of each rail. These fasteners are used to maintain gage and alinement of the track as well as restrain longitudinal movement of the continuous welded rail (CWR).<sup>1</sup> The track was supported by granite rock ballast.

## **Documentation of POD**

The investigation revealed an area in a curve where the subgrade fill was subsided from the track structure on No.1 main track. Railroad personnel found that this fill and ballast was subsided for about 26 feet, at a depth of about 18 inches upon their arrival on scene (See figure 1.) The fill continued to subside throughout the course of the on-scene investigation activities (See figure 2.) It was determined that the POD was near milepost CFP- 102.9; in this location NTSB investigators identified a flange mark traversing over the top of the rail head in the curve at the location of the subsided subgrade (See figure 3.) Investigators were unable to determine the amount of vertical deflection present on the low-rail in the curve at the time of the accident. However, the loss of fill under the track structure would have allowed vertical deflection of the low rail in the curve causing a geometry condition. Investigators photo documented flange and tread marks from the derailed rail car wheels that were found on various track components that were damaged by wheel impact. (See figure 4.) The POD was about 1/10<sup>th</sup> of a mile north of the

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<sup>1</sup> Continuous welded rail (CWR) means rail that has been welded together into lengths exceeding 400 feet

bridge spanning Norfolk Southern Railroad (NS) tracks at MP CFP-102.8.



*Figure 1. This photo shows the subgrade, fill-failure as it was about 4 hours after the derailment.*



*Figure 2. Aerial view of subgrade fill failure location on May 20th. Note additional degradation.*



*Figure 3. Photo showing the flange mark from a railcar wheel traversing over the top of the rail head in the curve at the location of the subsided subgrade.*



Figure 4. Photo showing track components damaged by wheel impact.

Track note measurements taken in the area of the derailment revealed an average degree of curvature of 2.0 -degrees with about 4-inches of super-elevation in the accident curve. Based on FRA minimum standards for curve elevation and speed limitations the curve qualified to be operated at 71 MPH for three-inch unbalance (freight rolling stock) and 76 MPH for four-inch unbalance (passenger equipment). Track notes also revealed that the within the stations documented in the full body of the curve track gage was 56-1/2 inches.



## Damaged Railroad Bridge

The bridge that was impacted was a two-span 205 feet long open deck through plate girder structure that was built in 1947. The bridge deck and first span were taken to the ground below the bridge superstructure. The damaged bridge's original design was an open deck, through plate girders, with two spans and a step span on the north end. On the bridge deck there were inner and outer guardrails.



*Figure 5. Aerial photo of displaced bridge structure. No. 1 track, MP CFP 102.8*

## **Damages Estimates**

CSX reported \$200,000 damages to the track structure. This consisted of 1800 feet of track renewal and ballast required to surface the area. This does not include additional costs associated with remediation efforts. Further, CSX reported that the bridge replacement and retaining wall construction cost was \$7 million.

## **Geotechnical Data Report**

On May 20, 2018, CSX directed Shannon & Wilson, Inc. which is a geotechnical and environmental firm to perform borings in the embankment of the area where the subgrade fill failure and derailment occurred.<sup>2</sup> The scope of these services was to perform six borings in the vicinity of the subgrade fill failure and derailment location to; 1) perform slope stability analysis representative of the slide, and 2) provide slide repair recommendations and retaining wall alternatives. Six borings were retrieved from both ends of the fill failure area and beyond, along the track in either direction. The following findings were discovered after the six borings were analyzed utilizing a computer program SLOPE/W (Geo-Slope International 2016);

- The embankment fill in the failure area was composed of relatively weak and wet soil
- There was a concentration of water in a ballast pocket after the successive heavy rains in the area which saturated the slope in the failure area
- A crib wall that was approximately two feet high and one-hundred feet long built from railroad ties stacked up three ties high was discovered in the fill failure area. It was determined that this crib wall did not contribute significantly to slope stability.

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<sup>2</sup> Shannon & Wilson, Inc. Geotechnical Data Report No: 100749-001-Slide MP CFP-102.9, Alexandria VA

## **Planned Remediation**

CSX reported that planned remediations include excavating the poor fill material within the fill failure location, building a seventy-foot-long soldier pile retaining wall, and replacing the removed fill with a more compactable structural backfill material.

## **Subgrade Fill Condition of the RF&P Subdivision**

Investigators asked CSX representatives for a historical perspective regarding subgrade fill conditions on the RF&P subdivision. The CSX response is below:

CSX is unaware of any other sudden fill failure on the RF&P since CSX acquired it, with the exception of 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. 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 similar to the area at Alexandria, but those areas have never progressed to anything beyond routine maintenance.

## **Geometry Testing**

CSX provided the last two geometry car survey reports for the RF&P subdivision. The most recent survey was conducted on May 7, 2018, or twelve (12) days prior to the accident. The Track and Engineering Group has reviewed the track geometry data from the May 7, 2018 report and found no conditions that exceeded FRA minimum safety standard thresholds at the accident location.

## **Internal Rail Tests Data**

CSX provided the last ultrasonic rail test reports for the RF&P subdivision that was conducted on February 01, 2018. The inspection was conducted by Test Car No. 707. The Track and Engineering Group reviewed the last ultrasonic inspection report dated February 01, 2018 and took no exceptions.

## **Track Inspection Records**

FRA regulations found in 49 CFR 213 require that a rail carrier's track inspection records be prepared and signed on the day of the inspection for frequency of compliance with the FRA Track Safety Standards (TSS). FRA track inspection records are required to reflect actual field conditions and deviations from the FRA/TSS. CSX has elected to operate at FRA Class 4 speeds in the accident area requiring CSX personnel to inspect the main track at least twice per calendar week.

The Track and Engineering Group, along with FRA representatives reviewed CSX track inspection records from April 01, 2018 and up to May 20, 2018 and took no exceptions to the reports and no defects were recorded at the point-of-derailment location.

## **Regulatory Track Inspection History**

The Track and Engineering Group reviewed FRA track inspection records dated back to December 2017 and took no exceptions to any reports. No FRA defects were recorded in the area of the accident at MP 102.9.

## **CSX Track Disturbance Reports**

CSX provided the track disturbance report dated August 30, 2017. The reports shows that the accident and point-of-derailment location on Main Track 1 was surfaced between CFP 102.8 and CFP 102.9. A prior track disturbance report dated April 06, 2017 shows that Main Track 1 was surfaced between CFP 101.7 and CFP 109.0.

## **Circumstances Prior to the Accident**

On Friday, May 18, 2018, the track inspector began an inspection at MP CFP 87.0 and was going to inspect north to MP CFP 110.07. This inspection was not required because the regulatory frequency had already been met. At about 09:38 a.m., the inspector was called and instructed to go to the south end of the territory to inspect the track due to a flash flood warning near Neabsoc, Virginia. Neabsoc, Virginia is about twenty-four (24) miles south of Alexandria, Virginia. Later that day, a wash-out was identified near MP CFP 18.6 which is about eighty-four (84) miles south of the accident and derailment site location.

A review of CSX's flash flood warning data revealed that no flash flood warnings were issued for the RF&P subdivision after 09:28 a.m. dated May 18, 2018, one (1) day prior to the accident.

## **Summary of CSX Engineering Department Employee Interviews**

The investigative team interviewed three CSX Engineering Department employees that were responsible for track inspection and maintenance of the CSX R&FP subdivision. Below is a summary of the interviews:

Track Inspector:

- CSX hire date 2001 - Present
- Worked in the Transportation Department as a Conductor for a brief time
- Inspection territory CFP 57.4 to CFP 110.7 and CFQ 0 to CFQ 9.9
- Felt comfortable with inspection duties
- Last track inspection performed through the accident area was high-railed via main track No. 2 on Wednesday, May 16, 2018 utilizing 2- inspectors
- Last track inspection traversing the accident main track No. 1 was on Friday, May 11, 2018
- Inspector stated that he had marked the low rail with cross-level measurements for easy referencing within the area where the subgrade fill-failure occurred
- Inspector stated that the subgrade fill-failure location overtime would “increase” cross-level
- An extra inspection of area was scheduled for Friday, May 18, 2018. Inspected up to MP 91.0, but was diverted to perform flood inspections further south

Roadmaster:

- CSX hire date January 2013
- Worked various engineering jobs; Track Inspector, Welder
- Became Assistant Roadmaster in 2014
- Performs riding inspections of his territory every other week
- Inspected through accident area on Monday, May 14, 2018 via main track No. 3

- Traversed main track No.1 on Monday, May 7, 2018
- Goal is to inspect his territory every week
- Did not recall any track defects or exceptions in the accident area from the last track geometry survey

Assistant Division Engineer-Track:

- CSX hire date 2006 – Present
- Hired as Trackman
- Worked 1-2 years as a Track Inspector
- Promoted in 2009 to Assistant Roadmaster in Point of Rocks
- Promoted in 2014 to Assistant Division Engineer- Track
- Performs monthly rides with Track Inspectors
- Knows of no work history for subgrade fill-failure accident area
- Last traversed the accident area on the CSX geometry car that operated on May 7<sup>th</sup>, 2018

Parties to the Investigation - Acknowledgment Signatures

The undersigned designated Party to the Investigation representatives attest that the information contained in this report is a factually accurate representation of the information collected during the investigation, to the extent of their best knowledge and contribution in this investigation.

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\_\_\_\_\_/s/\_\_\_\_\_  
Robert J. Gordon, NTSB

Date 10/25/18

\_\_\_\_\_/s/\_\_\_\_\_  
Troy Lloyd, NTSB

Date 10/25/18

\_\_\_\_\_  
Ronald McCormick, FRA

Date

\_\_\_\_\_  
Shane Ayers, VA SCC

Date 11/06/18

\_\_\_\_\_/s/\_\_\_\_\_  
David "Randy" Daniels, CSXT

Date 10/26/18

\_\_\_\_\_/s/\_\_\_\_\_  
Roy Morrison, BMWED

Date 11/13/18