National Transportation Safety Board

Office of Railroad, Pipeline, and Hazardous Materials

Washington, DC 20594

RRD24FR001

TRACK

Group Chair's Factual Report

November 20, 2023

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A. ACCIDENT DETAILS

Location:	Bragdon, Colorado
Date:	October 15, 2023
Time:	3:24 P.M. MDT
	9:24 P.M. UTC
Carrier:	BNSF Railway
Train:	C-ATMCRD0-31

B. TRACK GROUP

Group Chair	Troy Lloyd National Transportation Safety Board Washington, DC
Group Member	Darius Mack National Transportation Safety Board Washington, DC
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C. SUMMARY

On October 15, 2023, at approximately 3:24 PM MDT, southbound BNSF Railway (BNSF) freight train C-ATMCRD0-31 derailed 31 cars at Mile Post 109.656 on the BNSF Pikes Peak Subdivision. The derailment occurred about 5 miles north of Pueblo, Colorado. The derailment occurred as the train approached a railroad bridge. As a result of the derailment, the bridge collapsed onto the southbound lanes of Interstate 25, causing one fatality to a semi-truck driver who was trapped under the collapsed bridge. A large quantity of coal spilled onto the north and southbound lanes of I-25.

BNSF train C-ATMCRD0-31 was a loaded coal train consisting of 124 loads and 0 empties, with a weight of 17,719 tons and a length of 6582 feet. The train was equipped with 5 locomotives and was configured with two locomotives on the headend and three on the rear of the train. The total train length with locomotives was 6,950 feet. At the time of the derailment, the C-ATMCRD0-31 was traveling timetable south on Main Track 1 at 33 mph. The Pikes Peak Subdivision, at the location of the derailment, has a method of operation of centralized traffic control (CTC) with a positive train control (PTC) overlay. PTC was in use at the time of the derailment. Maximum speed at the location of the derailment was 45 mph. The 31 cars derailed were lines 5-35 from the head end of the train.

Figure 1**.** Aerial photo of the point of collision site. (source: BNSF Drone footage)

D. FACTUAL INFORMATION

1.0 Track Description

The Pikes Peak subdivision extends 119.2 miles between milepost 0.0 in Denver, CO to milepost 119.2 in Pueblo, CO. This Subdivision is mostly comprised of double-main track with segments of triple main track in S. Denver, CO, and one segment of single main track through Colorado Springs, CO. The subdivision's method of operation is primarily centralized train control (CTC) with a positive train control (PTC) overlay. Two segments of main track 2 is designated as track warrant control (TWC). The Pikes Peak subdivision is designated as FRA class 4 track with a maximum authorized speed of 60 m.p.h. At S. Bragdon the maximum authorized speed is 55 mph for trains under 100 tons per operative brakes (TPOB), and 45 mph for trains above 100 (TPOB). The tonnage for the Pikes Peak subdivision is 46 MGT southbound and 11 MGT northbound. Trains traveling southbound traverse a flat grade beginning at milepost 108.7 through the point of derailment to 109.8. At 109.8, a southbound train traverses a slight descending grade of -0.33 percent. In the accident location, the track alignment was tangent.

1.1 Track Details

The derailment occurred at the switch at S. Bragdon. The switch was a Atchison, Topeka, and Santa Fe (ATSF) #14 right-hand turnout. This switch was located approximately 116 ft north of a 180 ft long ballast-deck bridge that consisted of two 90 ft steel spans over Interstate 25. The rail on main track 1, was 136 lb. RE continuously welded rail (CWR), and the rail throughout the switch was also 136 lb. RE of various manufacturers. The main track consisted of 8.5' hardwood crossties and various-sized switch ties throughout the S. Bragdon switch. The rail was fastened to the crossties using standard double-shoulder tie plates with a 6" rail base and cut spikes. The rail through the turnout was fastened to the switch ties using steel hook plates. The frog section of the switch used Pandrol e-clips and lag screws. 2" crushed granite ballast was used throughout this segment of track.

1.2 Railroad Bridge Damage

The BNSF bridge located at M.P. 109.70 was damaged as a result of this derailment. The bridge is a 180 ft long ballast deck through plate girder structure that was built in 1958. The substructure consisted of reinforced concrete abutments on each end and one pier center of the structure. The derailment resulted in the North span being taken to the ground and on to highway (I-25) below. The bridge was last inspected on August 16, 2021. No new notes were recorded in this inspection however notes from the previous inspection that was completed on September 24, 2020, was carried over as "open informational exceptions" All three of

these exceptions reference “old hit damage” on various parts of the bridge girder. A second previous inspection that was completed on September 3, 2019, also recorded three “informational exceptions”, which all state “map cracking all over pier”.

1.3 Point of Derailment

Investigators determined that the point of derailment (POD) was at MP 109.656 on the West rail (Main 1 straight lead) between the frog section and the heel block. This location was approximately 21 crossties North of the switch points. Witness marks were located on the East rail at this location and video footage captured from the rear locomotive of the previous train shows a broken rail.

1.4 Track Conditions / Maintenance

The derailment caused severe damage to the turnout section of the switch. There was a total of about 215 ft of track damage including the switch. A rail recovery and rebuild was constructed on site. Approximately 90% of the rail was recovered from the wreckage organized in a staging area East of the track. The rail in the area of the derailment, was 136 lb. and varied by manufactured and year rolled. The majority of rail was manufactured by Bethlehem Steel in 1996 and Rocky Mountain Steel Mill in 2004. Two thermite field welds were in the area of the point of derailment. Both welds were on the west rail and main track 1, between the heel block and the guard rail. The South weld (Weld #71) was made by a BNSF Welder on May 24, 2023. This weld showed signs of friction batter on the head and web of the south rail end. The second weld was located 71” north and was made by a BNSF welder on June 19, 2007. This rail showed sign of sudden catastrophic failure. Three pieces of rail, which included the welds were sent to the NTSB Materials lab for group examination.

Figure 2**.** Thermite Field Weld #71 MP 109.656 made on 5-29-2023 (Source: NTSB)

1.5 Thermite Welding Procedures

Railroad thermite welding is a welding method that uses the heat of chemical reaction as the heat source. The ends of two rails are fixed in a mold and then a mixture of aluminum and iron oxide is heated in a crucible. An exothermic reaction produces liquid iron and molten slag which is injected into the mold. The liquid iron fills into the mold creating the weld, while the slag floats to the surface and is removed. Single-use welding Kits include all the materials needed to create the thermite weld, including the mold for the specific rail size. Rails of different sizes may also be joined using special compromise welding kits. The rails must be pre-heated to the required temperature for proper fusion to take place.

BNSF welders are trained in thermite welding procedures at Johnson County Community College in Overland Park, Kansas. Thermite welding procedures is a 2-week 80-hour course that provides instruction on the basic procedures, chemical reactions, safety, and finishing. Students are required to demonstrate proficiency to complete this course.

Figure 3**.** Thermite Field Weld Process (Source: mechanicalportal.com)

BNSF's Thermite Welding Manual[1], 7.9 (Appropriate Welding Molds), states that welding 136 lb. rail ends which have a height differential of 1/8" through 1/4" require the use of a 132/136 compromise welding kit. Goldschmidt's (manufacturer of Orgo-Thermit®) procedures[2] also require (Table 7.1) that rail ends with greater than 1/8" of rail height difference, utilize a compromise welding kit to properly weld the joint and joining rails with height differences of greater than ¼" is prohibited. The Orgo-Thermit® welding kit used for weld #71 was a standard 136 lb. welding kit. The rails joined at this weld were not previously drilled for joint bars and had a difference in rail height of 3/16"[3].

2.0 Track Inspections

2.1 BNSF Track Inspections

49 CFR Part 213.233, Inspections, requires that a rail carrier perform an inspection of the track twice per week with a minimum of one day between inspections on a Main track where the tonnage exceeds 10 million gross tons (MGT) the prior year. BNSF completed two track inspections the week before the derailment. The first inspection was conducted on October 9, 2023. This inspection

[1] BNSF Railway – Thermite Welding Manual – rules and procedures (January 1, 2016)
[2] Goldschmidt – Orgo-Thermit operating procedures manual document (November 3, 2022).
[3] Figure 4. Rail Profile measurement diagram.

recorded zero defective conditions between M.P. 84.397 and M.P. 120.177. The second inspection was conducted on October 11, 2023, between M.P. 108.2 and M.P. 120.177. No defective conditions were recorded on this inspection. A third inspection was conducted on October 13, 2023. This record indicated the limits of this inspection were between M.P. 84.397 and M.P. 109.7, however, it was determined that there was an error in the reporting and this 3rd inspection ended at M.P. 108.2. BNSF met the required inspection frequency for this segment of track.

2.2 Ultrasonic Rail Test

FRA regulations found in 49 CFR Part 213.237, Inspection of Rail, require that a rail carrier perform a search for internal rail defects. BNSF conducted four ultrasonic rail tests within the year prior to the derailment. All tests were performed by Herzog Services, Inc. The first rail test was conducted on November 10, 2022. This test identified three defective conditions within 10 miles of the derailment location. One of those conditions was located within the proximity of the derailment at M.P. 109.668. The defect type was recorded as defect #317 "Shelled/Spalled/Corrugated rail" on the left rail. The following ultrasonic test was completed on January 27, 2023. This test identified four defective conditions within the previously specified limits. None of the recorded conditions were at the derailment location. The third test was conducted April 15th, 2023. The final test prior to the derailment was conducted on July 19, 2023. This test identified six rail conditions, none of which were at the location of the derailment. A review of the B scan for the most recent rail test was conducted by FRA and NTSB as part of this investigation.

2.3 Geometry Car Test

A review of geometry test car defects was conducted as part of the investigation. The defects that were reviewed included all surface and gage conditions recorded by various test cars starting one year prior to the derailment on the BNSF's Pikes Peak Subdivision, between M.P. 97 and 117. Only one condition was recorded in the area of the derailment. This condition was found on August 8, 2023, with test vehicle UMT004. The condition was classified at a yellow tag condition not requiring immediate action and was identified as "TOP_CHORD" measuring 1.02". This condition was recorded again on September 20, 2023, and a third time on October 15, 2023. This vehicle measured the condition at 1.04". CFR 49 Part 213.63, Surface, does not reference a "TOP_CHORD" condition. This condition is non-regulated and is only used by BNSF to identify surface irregularities that could affect coal cars.

FRA's automated track inspection vehicle (DOTX220) also surveyed the Pikes Peak Subdivision on October 2, 2023. The survey started in Denver, CO (M.P. 5) and ended in Avondale, CO (M.P. 605). The survey recorded a deviation from uniform profile approximately at the point of derailment. This condition was located on the

right rail and measured 1.88". This condition met the requirement for FRA class 4 track. No other defective conditions were identified within the area of the derailment.

2.4 Regulatory Track Inspection History

FRA conducted two regulatory track inspections on the Pikes Peak Subdivision within the year prior to the derailment. These inspections were conducted on August 11, 2022, and July 11, 2023. The defective conditions discovered in these two inspections were recorded on forms FRA F 6180.96 KGO #83 and KGO #52 respectively. NTSB has reviewed these records and noted that one defective condition was discovered on the August 11th inspection in the area of the derailment. This defect was recorded as "Ballast failing to maintain proper geometry" at M.P. 109.69. A geometry measurement was not recorded in FRA's inspection report. BNSF provided documentation stating that the defective condition was repaired on September 9, 2022, by "placing ballast".

E. POST-ACCIDENT INVESTIGATION

3.0 Image/Video Footage

BNSF provided photo images from train C-BTMSPS0-33D, which previously traversed the derailment location before the derailing train. Images were taken from both the lead and rear locomotives of this train and analyzed as part of this investigation. Video from the leading locomotive and a locomotive positioned mid-train were also reviewed. BNSF provided high-definition imagery of the two welds that were taken on June 9th, 2023, using a BNSF track imaging system.

4.0 Evidence Collection

NTSB identified three segments of rail related to the two field welds involved in the accident. These rails were documented as evidence and transported to NTSB's material laboratory in Washinton, D.C for analysis. Rail #1 was 49" in length, Rail #2 was 75" in length and Rail #3 was 60" in length. All three segments were from the west rail on the main track. A group examination of the rail was conducted on December 12th and 13th of 2023. The rails were then transferred to a BNSF test lab in Topeka, KS to complete additional test procedures.

Rail profile measurements of rails that were joined at weld #71 were taken during the examination. There was a height difference of 0.17724 (3/16") between the north rail (A-Rail) and the south rail (B-Rail).

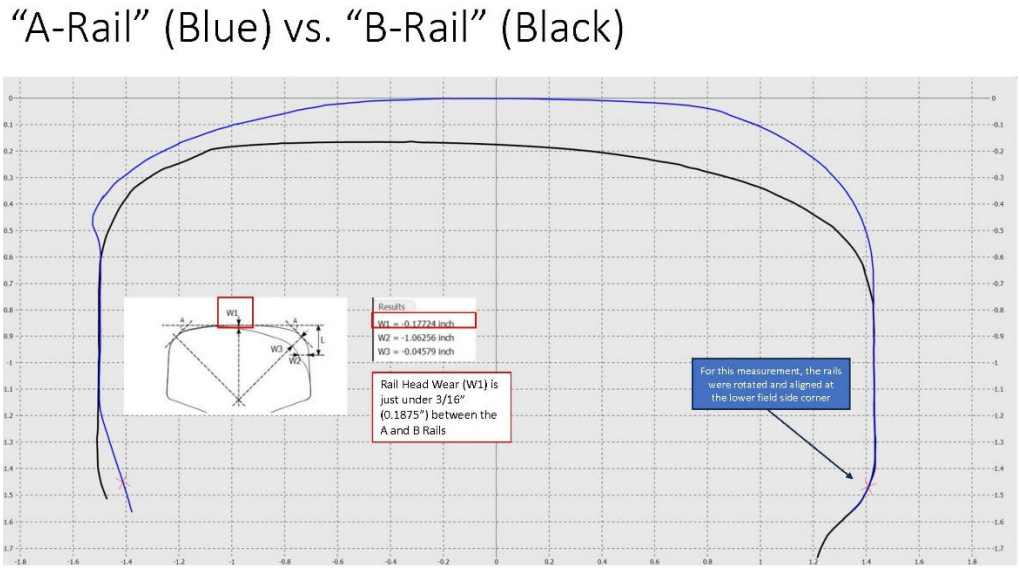

Figure 4. Rail wear references (Source: Miniprof / NTSB)

5.0 Post Accident Inspections

The BNSF investigation team conducted a post-accident inspection in the derailment area which included taking track measurements. The track measurements covered 248 ft. (17-stations) of track that was measurable North of the derailment site. The track South of station #1 was destroyed and measurements could not be taken. The maximum difference from zero cross level within this segment of track was 1/4". The maximum deviation from uniform profile was 5/8" and the maximum gage was 56-1/2". Rail wear measurements were also taken on the joining rail at weld #71. The head loss of the stock rail of the switch ranged between 1/32" to 5/32". There was 0" rail wear on the switch point and 3/16" loss on the curve closure rail.

6.0 Damage Estimates

BNSF reported that the estimated track damage for this derailment was $10,400,000. The mechanical damages were estimated at $2,353,722.

APPENDIX A

Figure 5. Still photo captured from the rear locomotive on BNSF train C-BTMSP50-33D, at 1:30 p.m. on 10-15-2023. The image shows a broken rail on the left stock rail that was not present on head-end video footage (Source: BNSF)

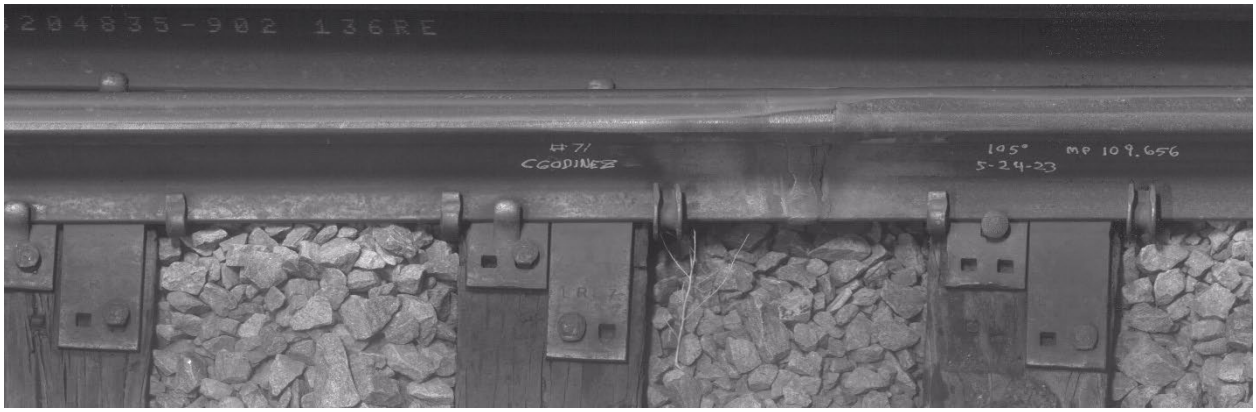

Figure 6. Image of thermite weld #71 on June 9th, 2023 (Source: BNSF)

Submitted by:

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