

# National Transportation Safety Board

Office of Railroad, Pipeline and Hazardous Materials

Washington, DC 20594



RRD24FR001

## **SIGNAL & TRAIN CONTROL**

Group Chair's Factual Report

December 20, 2023

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## **A ACCIDENT**

Location: Pueblo, Colorado  
BNSF Railway, Powder River Division, Pikes Peak Subdivision  
Main Track 1  
Date: October 15, 2023  
Time: 3:24:34 mountain daylight time  
Train: Southbound BNSF Coal Train C-ATMCRDO-31D

## **B SIGNAL & TRAIN CONTROL GROUP**

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## **C ACCIDENT SUMMARY**

For a summary of the accident, refer to the Accident Summary report within this docket, RRD24FR001.

## **D DETAILS OF THE INVESTIGATION**

### **1.0 Description of BNSF Pikes Peak Subdivision**

The BNSF Pikes Peak Subdivision of the Powder River Division that extended from milepost 0.0 (Control Point [CP] 20th St in Denver, CO) to milepost 120.2 (CP

Pueblo Junction in Pueblo, CO) in a north-south timetable direction. The Pikes Peak Subdivision consisted of single, two, and three-main track territory with passing sidings. Milepost numbering increased in a timetable south direction. Maximum authorized timetable speed on main track 1 between milepost 84.4 and milepost 120.3 was 55 mph for trains under 100-tons per operative brake and 45 mph for trains 100-tons per operative brake or over.

In the vicinity of the derailment area, BNSF authorized train movements with a Traffic Control System (TCS). Train movements were coordinated by a train dispatcher located at the BNSF Network Operations Center in Fort Worth, Texas. Train movements on the Pikes Peak Subdivision were governed by operating rules, special instruction, timetable instructions, and the signal indications of the TCS. The subdivision was supplemented with an overlaid Positive Train Control (PTC) system, between milepost 0.0 and milepost 119.2 on main track 1.

Trackside warning devices that included hot wheel defect detectors, hot bearing defect detectors, dragging equipment detectors, and high-water detectors were present on the subdivision.

The Union Pacific Railroad (UP) also retained main track ownership (see Table 1) and managed train operations along the entirety of the Pikes Peak Subdivision. The UP main tracks were incorporated into the UP Colorado Springs Subdivision of the Denver Division, with train movements coordinated by the dispatcher located at the UP Harriman Dispatch Center in Omaha, Nebraska. BNSF and UP delineated specific operating jurisdictions (see Table 2) within the Pikes Peak Subdivision. The BNSF timetable, special instructions, and operating rules applied on the UP owned main tracks.

**Table 1: Pikes Peak Subdivision Main Track Ownership**

<b>Track</b>	<b>Segment Milepost (MP)</b>	<b>Owner</b>
Main Track 1 (MT1)	MP 0.0 to MP 24.87	UP
	MP 24.87 to MP 48.97	BNSF
	MP 48.97 to MP 52.0	UP
	MP 84.36 to MP 84.49	BNSF
	MP 84.49 to MP 86.54	UP
	MP 86.54 to MP 120.3	BNSF
Main Track 2 (MT2)	MP 0.0 to MP 25.2	BNSF
	MP 25.2 to MP 49.78	UP
	MP 49.78 to MP 51.85	BNSF
	MP 51.85 to MP 52.0	UP
	MP 84.36 to MP 86.15	BNSF
	MP 86.15 to MP 120.26	UP
Main Track 3 (MT3)	MP 4.4 to MP 12.5	BNSF
Single Main Track	MP 52.0 to MP 78.75	UP

**Table 2: Pikes Peak Subdivision Operating Jurisdictions**

<b>BNSF Dispatcher</b>	<b>UP Dispatcher</b>
MP 0.0 to 12.2	
MP 12.2 to MP 52.0 (Main Track 1)	MP 12.2 to MP 52.0 (Main Track 2)
MP 52.0 to MP 84.4	
MP 84.4 to MP 107.9 (Main Track 1 & 2)	MP 84.4 to MP 107.9 (Main Track 1)
MP 107.9 to MP 120.3 (Main Track 1)	MP 107.9 to MP 118.2 (Main Track 2)

## **2.0 Description of Signal System**

The signal system used coded track circuits for train occupancy detection. Wayside signals were color light signals with upper and lower signal heads capable of displaying green, yellow, and red aspects for train movement in either direction. The signal heads used 10-volt, 18-watt incandescent lamps to display signal aspects.

The wayside signal equipment at CP South Bragdon (milepost 109.70) consisted of color light signals, a power-operated switch machine, and Vital Harmon Logic Controller (VHLC) <sup>1</sup>. The track circuits within the CP were direct current (DC) track circuits.

The subdivision was equipped with a PTC system, consisting of Interoperable Electronic Train Management System (I-ETMS).

## **3.0 Post Accident Signal and Train Control Examination**

The post-accident investigation found all wayside signal equipment and appurtenances at control point South Bragdon, locked and secured with no indications of tampering or vandalism. Wayside signals were aligned to their corresponding track and no physical obstructions were noted.

BNSF signal maintenance, inspection and test records were obtained for the most recent completed monthly, quarterly, yearly, relay, time locking, route locking, indication locking, and insulation resistance test records for wayside signal locations between CP South Bragdon and CP Bragdon.

One year of signal malfunction reports (signal trouble tickets) were obtained between CP South Bragdon and CP Bragdon.

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<sup>1</sup> The VHLC is a solid state, programmable controller designed to control wayside signals, switches, and track circuits at railroad interlocking locations.

### 3.1 Signal System and PTC Data Logs

Wayside TCS data logs for CP South Bragdon (milepost 109.7), were downloaded for the investigation. The VHLC data logs from CP South Bragdon were examined to develop a timeline of signal events and summarized in Table 1.

**Table 4: CP South Bragdon - Wayside VHLC Data Log**

<b>Time<sup>2</sup></b>	<b>Event</b>
12:53:07:	<ul style="list-style-type: none"><li>OS track circuit indicates unoccupied (previous train C-BTMSPSO-33D)</li></ul>
2:41:07	<ul style="list-style-type: none"><li>Southbound MT1, home signal requested (train C-ATMCRDO-31D)</li></ul>
2:41:08	<ul style="list-style-type: none"><li>Southbound MT1, home signal indicated lined</li></ul>
3:24:19	<ul style="list-style-type: none"><li>OS track circuit indicates occupied (train C-ATMCRDO-31D)</li><li>Southbound MT1, home signal indicates at Stop</li></ul>
3:24:34	<ul style="list-style-type: none"><li>Switch indicates out of correspondence</li></ul>

Wayside PTC data logs for CP South Bragdon (milepost 109.7) were downloaded for the investigation. Data logs were examined to develop a timeline of signal events and summarized in Table 2.

**Table 5: CP South Bragdon - PTC, Device State Data Log**

<b>Time<sup>3</sup></b>	<b>Event</b>
12:50:46:	<ul style="list-style-type: none"><li>OS track circuit indicates occupied (previous train C-BTMSPSO-33D)</li></ul>
2:41:09	<ul style="list-style-type: none"><li>Southbound MT1, home signal at Clear</li></ul>
3:24:19	<ul style="list-style-type: none"><li>Southbound MT1, home signal at Stop</li></ul>
3:24:34	<ul style="list-style-type: none"><li>Switch invalid</li></ul>
3:24:56	<ul style="list-style-type: none"><li>Northbound MT1, home signal cycles Stop/Dark</li></ul>

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<sup>2</sup> Clock times are local microprocessor times set to Mountain Daylight Time

<sup>3</sup> Clock times are local microprocessor times set to Mountain Daylight Time

BNSF Dispatch Center logs (code line data logs) for CP South Bragdon were examined to develop a timeline of signal events and summarized in Table 3.

**Table 6: CP South Bragdon - Code Line Data Log**

<b>Time<sup>4</sup></b>	<b>Event</b>
3:10:38:	<ul style="list-style-type: none"> <li>• Switch lined normal</li> </ul>
3:41:14	<ul style="list-style-type: none"> <li>• Southbound route lined and plant locked</li> </ul>
4:22:34	<ul style="list-style-type: none"> <li>• 1TK indicates occupied</li> </ul>
4:24:22	<ul style="list-style-type: none"> <li>• WGK occupied (Block indicator)</li> </ul>
4:24:34	<ul style="list-style-type: none"> <li>• Track circuits occupied (train occupying approach, OS and leaving track circuits)</li> </ul>
4:24:38	<ul style="list-style-type: none"> <li>• Switch out of correspondence</li> </ul>
4:24:59	<ul style="list-style-type: none"> <li>• Light out indication (Northbound home signal and switch heater destroyed)</li> </ul>
4:25:06	<ul style="list-style-type: none"> <li>• Signal bungalow POK True (power out)</li> </ul>

PTC back-office data logs for CP South Bragdon were examined to develop a timeline of signal events and summarized in Table 4.

**Table 7: CP South Bragdon - PTC Back Office Data Log**

<b>Time<sup>5</sup></b>	<b>Event</b>
3:41:13:	<ul style="list-style-type: none"> <li>• Southbound MT1 home signal Clear</li> <li>• Switch lined normal.</li> <li>• Southbound Siding home signal at Stop</li> <li>• Northbound MT1 home signal at Stop</li> </ul>
4:24:24	<ul style="list-style-type: none"> <li>• All signals at Stop</li> </ul>
4:24:37	<ul style="list-style-type: none"> <li>• Switch indeterminate</li> </ul>
4:25:01	<ul style="list-style-type: none"> <li>• Northbound MT1 home signal Dark</li> </ul>

### **3.2 BNSF Signal System Maintenance, Inspection and Test Records**

BNSF signal maintenance, inspection and test records that included monthly, quarterly, yearly, relay, time locking, route locking, indication locking, and insulation resistance tests were reviewed for wayside signal locations between CP South Bragdon and CP Bragdon.

<sup>4</sup> Clock times are Dispatch Center times set to Central Daylight Time

<sup>5</sup> Clock times are Dispatch Center times set to Central Daylight Time

The monthly and quarterly switch tests and inspections at CP South Bragdon was last performed on October 11, 2023. Relay test and inspections were last performed on July 19, 2021, and were noted to be within the proper tolerances. Insulation resistance tests were performed on September 23, 2019, and with no exceptions noted. Locking tests at CP South Bragdon were last performed on February 28, 2022, with no exceptions noted<sup>6</sup>.

### **3.3 Wayside Defect Detectors**

Data downloads from the two previous wayside defect detectors traversed by BNSF Train C-ATMCRDO-31D, were obtained, and examined. The wayside detector located at milepost 108.23 was a dragging equipment detector and the data logs indicated BNSF Train C-ATMCRDO-31D traversed the detector at approximately 03:21 p.m., MDT, with a total of 526 train wheel axels detected and no noted alarms. The wayside detector at milepost 103.40 was a hot wheel bearing and dragging equipment defect detector. The data logs indicated BNSF Train C-ATMCRDO-31D traversed the detector location at approximately 03:15 p.m., MDT, with a total of 129 cars and 526 train wheel axels detected and no defects or alarms noted.

### **3.4 Highway-Rail Grade Crossing**

Event recorder data logs from the nearest highway-rail grade crossing traversed by BNSF Train C-ATMCRDO-31D, were obtained for the investigation. The highway-rail grade crossing was located at Pinon Road, milepost 106.38, DOT #003505S, near Pueblo, Colorado. The highway-rail grade crossing warning system log indicated the warning devices activated at 03:18:49 p.m., MDT, for BNSF Train C-ATMCRDO-31D with a calculated detection speed of 36 miles per hour (MPH) and provided a 48 second warning time.

### **3.5 BNSF Signal System Malfunction Reports**

One year of BNSF signal malfunction reports (signal trouble tickets) between CP South Bragdon and CP Bragdon were reviewed for this investigation. Table 1 and Table 2 summarize the relevant signal system malfunction reports for CP South Bragdon and CP Bragdon.

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<sup>6</sup> BNSF received a waiver from the Federal Railroad Administration on the requirements of periodic testing (locking tests) of solid state, microprocessor-based systems. BNSF was granted relief from the required periodic testing schedule of "at least once every 2 years" and is allowed to perform a microprocessor locking test "at least once every 4 years".



**Table 8: CP South Bragdon Signal Malfunction Reports**

<b>Date</b>	<b>Report</b>	<b>Remedy</b>
01-20-2023	Track Indication	Broken Rail at milepost 104.1.
09-12-2023	Track Indication	Broken Rail at milepost 109.7.
10-07-2023	Track Indication	Broken Rail at milepost 109.1.
10-15-2023	Derailment South Bragdon	

**Table 9: CP Bragdon Signal Malfunction Reports**

<b>Date</b>	<b>Report</b>	<b>Remedy</b>
11-30-2022	Track Indication	Broken Rail at milepost 105.49.
02-16-2023	Switch will not line reverse	Snow obstructing switch. Cleared snow and working as intended.
02-24-2023	Switch out of correspondence	Replaced switch motor for No. 2 switch.
03-16-2023	Switch will not line normal	Packed snow in switch point. Cleared snow and working as intended.
04-04-2023	Track Indication	Broken Rail at milepost 105.6.
08-01-2023	Track Indication	Heavy lighting in the area. Power cycled cabinet, checked grounds and arrestors.
09-16-2023	Track Indication	Broken Rail at milepost 104.75.
10-08-2023	Track Indication	Replaced Insulated Joint at No. 2 Switch

#### **4.0 BNSF Locomotive 9015**

The BNSF 9015 lead locomotive PTC equipment was examined as part of the investigation. The examination included checking seals, fasteners, wiring, operation lights, locomotive mounted antennas, and PTC display. No exceptions were noted.

Data from the locomotive onboard PTC system was downloaded from the BNSF 9015. Table 1 is a summary of the locomotive PTC log.

**Table 3: BNSF 9015, Locomotive PTC Log**

<b>Time<sup>7</sup></b>	<b>Event</b>
3:21:43:	<ul style="list-style-type: none"><li>• CP Bragdon indicated switch lined in the normal position and Southbound MT1, home signal at clear</li></ul>
3:22:45	<ul style="list-style-type: none"><li>• CP South Bragdon indicated switch lined in the normal position and Southbound MT1, home signal at clear</li></ul>
3:24:24	<ul style="list-style-type: none"><li>• CP South Bragdon Southbound MT1, home signal at Stop</li></ul>

## **5.0 Signal & Train Control Damage Estimates**

As a result of the derailment, the power-operated switch machine, northbound home signal, and signal bungalow at CP South Bragdon were damaged. BNSF estimated signal damages to be at \$55,000.

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<sup>7</sup> Clock times are local Mountain Daylight Time