



***Federal Railroad Administration
Office of Railroad Safety***

***Accident Investigation Report
HQ-2020-1389***

***BNSF Railway
Winslow, Arizona
July 6, 2020***

Note that 49 U.S.C. §20903 provides that no part of an accident or incident report, including this one, made by the Secretary of Transportation/Federal Railroad Administration under 49 U.S.C. §20902 may be used in a civil action for damages resulting from a matter mentioned in the report.

SYNOPSIS

On Monday, July 6, 2020 at approximately 6:00 a.m., MDT, a BNSF freight train derailed 29 railcars on the Gallup Subdivision near Winslow, Arizona. The BNSF SKCKSCO1 04K (Train 1), was traveling westbound at approximately 4 mph, when the train derailed at Milepost (MP) 279.3. The method of operation on the Gallup Subdivision within the area of the derailment is 2 Main Track with Centralized Traffic Control (CTC), Positive Train Control (PTC), and a maximum authorized speed for freight trains of 70 mph. Train 1 had slowed to a stop for a signal, and after observing a proceed indication, began pulling until the train experienced a undesired emergency (UDE). Inspection of the train revealed the derailment of 29 cars in the upright position. The train length was 10,954 feet, 14,493 tons, with 6 locomotives and 143 cars in the consist.

The estimated monetary damage to mechanical equipment was \$560,312 and \$300,000 to track and structure.

No injuries were reported.

There were no hazardous materials released.

Weather was clear, 80 °F.

The probable cause is cause code H519 -- Dynamic Brake, too rapid adjustment.

Contributing to the cause of the derailment was a block of 5 empty cars placed ahead of a block of 6,900 trailing tons, cause code H504--Buffing or slack action excessive, train make-up and FRA fatigue analysis found fatigue was present in both the engineer and conductor which may have had a contributing effect, cause code H199--Employee physical condition.

TRAIN SUMMARY

1. Name of Railroad Operating Train #1 BNSF Railway Company	1a. Alphabetic Code BNSF	1b. Railroad Accident/Incident No. SW-0720-103
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GENERAL INFORMATION

1. Name of Railroad or Other Entity Responsible for Track Maintenance BNSF Railway Company	1a. Alphabetic Code BNSF	1b. Railroad Accident/Incident No. SW-0720-103
2. U.S. DOT Grade Crossing Identification Number	3. Date of Accident/Incident 7/6/2020	4. Time of Accident/Incident 6:00 AM
5. Type of Accident/Incident Derailment		
6. Cars Carrying HAZMAT 10	7. HAZMAT Cars Damaged/Derailed 0	8. Cars Releasing HAZMAT 0
9. People Evacuated 0		
10. Subdivision BNSF RAILWAY COMPANY - GALLUP		
11. Nearest City/Town WINSLOW	12. Milepost (to nearest tenth) 279.30	13. State Abbr. AZ
14. County NAVAJO		
15. Temperature (F) 80 °F	16. Visibility Dawn	17. Weather Clear
18. Type of Track Main		
19. Track Name/Number Main 2	20. FRA Track Class Freight Trains-80, Passenger Trains-90	21. Annual Track Density (gross tons in millions) 104.17
22. Time Table Direction West		
23. PTC Preventable No	24. Primary Cause Code [H519] Dynamic brake, too rapid adju	25. Contributing Cause Code(s) H199, H504

OPERATING TRAIN #1

1. Type of Equipment Consist: Freight Train		2. Was Equipment Attended? Yes		3. Train Number/Symbol S-KCKSCO1-04K							
4. Speed (recorded speed, if available) R - Recorded 4.0 MPH E - Estimated	Code R	5. Trailing Tons (gross excluding power units) 14493	6a. Remotely Controlled Locomotive? 0 = Not a remotely controlled operation 1 = Remote control portable transmitter 2 = Remote control tower operation 3 = Remote control portable transmitter - more than one remote control transmitter			Code 0					
6. Type of Territory Signalization: <u>Signaled</u> Method of Operation/Authority for Movement: <u>Signal Indication</u> Supplemental/Adjunct Codes: <u>Q, J</u>											
7. Principal Car/Unit	a. Initial and Number	b. Position in Train	c. Loaded (yes/no)	8. If railroad employee(s) tested for drug/alcohol use, enter the number that were positive in the appropriate box	Alcohol	Drugs					
(1) First Involved (derailed, struck, etc.)	BNSF 782042	40	no		0	0					
(2) Causing (if mechanical, cause reported)				9. Was this consist transporting passengers?	No						
10. Locomotive Units (Exclude EMU, DMU, and Cab Car Locomotives.)	a. Head End	Mid Train		Rear End		11. Cars (Include EMU, DMU, and Cab Car Locomotives.)	Loaded		Empty		e. Caboose
		b. Manual	c. Remote	d. Manual	e. Remote		a. Freight	b. Pass.	c. Freight	d. Pass.	
(1) Total in Train	4	0	2	0	0	(1) Total in Equipment Consist	119	0	24	0	0
(2) Total Derailed	0	0	0	0	0	(2) Total Derailed	20	0	9	0	0
12. Equipment Damage This Consist 560312		13. Track, Signal, Way & Structure Damage 300000									
Number of Crew Members				Length of Time on Duty							
14. Engineers/Operators 1	15. Firemen 0	16. Conductors 1	17. Brakemen 0	18. Engineer/Operator Hrs: 9 Mins: 50		19. Conductor Hrs: 9 Mins: 50					
Casualties to:		20. Railroad Employees	21. Train Passengers	22. Others	23. EOT Device? Yes		24. Was EOT Device Properly Armed? Yes				
Fatal	0	0	0	0	25. Caboose Occupied by Crew?		N/A				
Nonfatal	0	0	0	0							
26. Latitude 34.991644000		27. Longitude -110.591891000									

SKETCHES

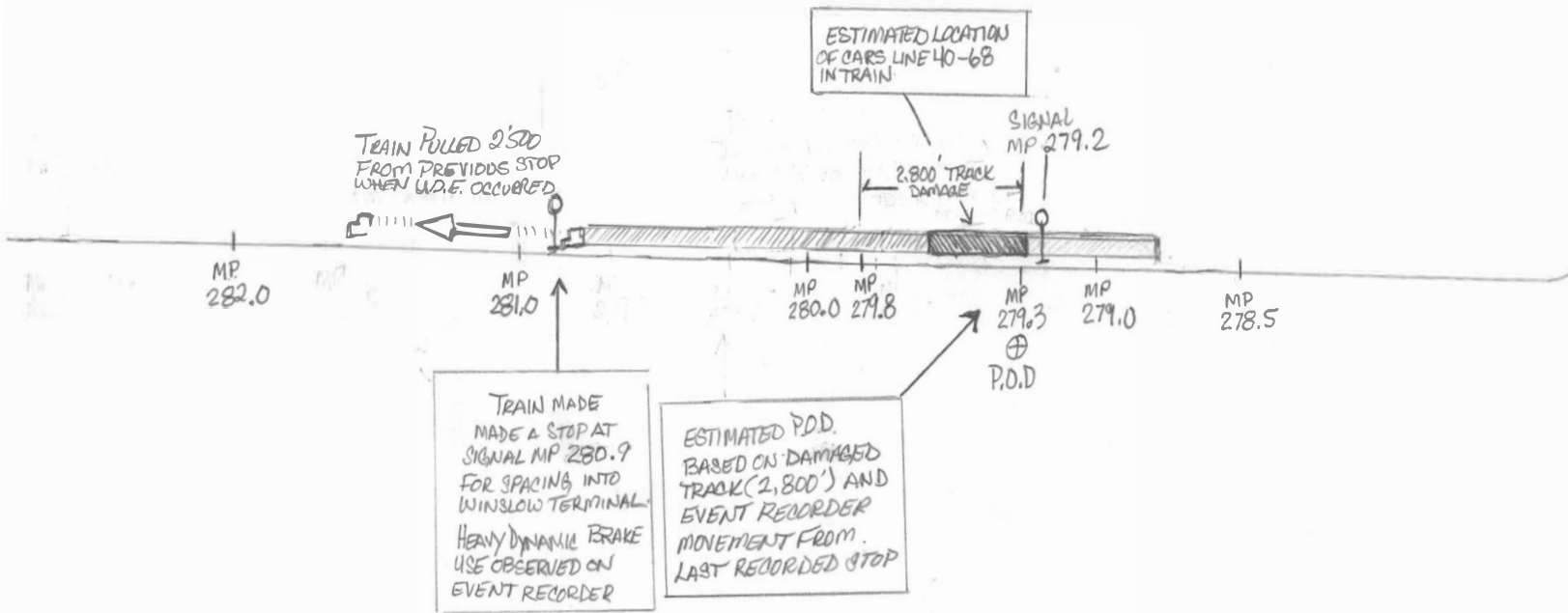
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BNSF
Winslow, AZ HQ-2020-1389
SKK&COI-04 TRAVELING
WESTBOUND AT 11 MPH WHEN
UNDESIRED EMERGENCY BRAKE (U.D.E.)
APPLICATION OCCURRED.

TRAIN CONSIST
4 LOADS H/E
2 DPU'S BETWEEN LINE 33+34
TRAIN LENGTH 11,393 (w/LOADS)
TONNAGE 14,497 TONS
CARS IN TRAIN 143
LOADS 119
EMPTIES 24
CARS DERAILED LINES 40 TO 68



DIAGRAM NOT TO SCALE



NARRATIVE

For clarity and uniformity in this report, directions will be given per timetable directions for east and west, and times will be given in local time unless otherwise indicated.

Circumstances Prior to the Accident

BNSF Railway Company (BNSF) westbound freight train S-KCKSCO1-04 (Train 1) was a mixed freight train with 4 head end locomotives, 2 mid-train distributed power (DP) locomotives placed between lines 33 and 36, with 119 loaded cars and 24 empties, for a total train length of 10,954 ft. and 14,493 trailing tons. It departed Kansas City, Kansas, on July 4, 2020, after receiving a class I brake test and pre-departure mechanical inspection by qualified mechanical inspectors. It was PTC-enabled and equipped with Trip Optimizer.

The crew of the Train 1, a locomotive engineer and conductor, went on duty at 7:40 p.m., at Belen, New Mexico. This was the crew's home terminal and both had received their statutory required off-duty time. Upon arrival into Belen, the inbound train crew with the assistance of the outbound crew, performed a required Class 1A air brake test without exceptions. Train 1 departed Belen at approximately 12:55 a.m., July 6, 2020.

Per BNSFs Southwest Timetable Gallup Subdivision Timetable No. 7 dated June 26, 2019, the maximum authorized timetable speed for westbound freight traffic at MP 280.5 is 70 mph. The area is 2 Main Track CTC, tangent track, through undulating high desert terrain. MP 280.5 is approximately 8 miles East of Winslow, Arizona. The tracks run parallel to Interstate 40 just to the North.

Weather at the time of the accident was pre-dawn, clear skies and a temperature of 80° F.

The Accident

On July 6, 2020, at approximately 6:00 a.m., as the train was accelerating on a .18 percent descending grade at 11 mph, the train experienced an undesired emergency (UDE) brake application that brought the train to a stop.

The conductor then contacted the dispatcher and local mechanical personnel. The crew received a radio transmission from mechanical personnel in the area who informed the crew they had cars derailed in their train. The engineer informed the dispatcher of their derailed status, and a further inspection revealed 29 rail cars, lines 40 to 68 from the head end, had derailed.

The derailment occurred at MP 279.3 on the BNSF Gallup Subdivision, Southwest Division between stations West Hibbard and East Winslow. The crew was not injured and the accident did not meet Title 49 Code of Federal Regulations (CFR) Part 219 Post Accident Testing requirements. The damages were estimated at \$560,312 for equipment and \$300,000 for track.

Post-Accident Investigation

On July 9, 2020, the FRA began an investigation of this accident. FRA investigators requested all necessary event recorder downloads, dispatcher audio files, records, forms, and other documentation necessary to conduct the investigation.

The following analysis and conclusions represent the findings of the FRA investigation.

Analysis and Conclusions

Analysis- Operating Practices Training and Qualifications: FRA requested and received training, testing

and certification documentation for both crew members. A review of crewmember records revealed no exceptions with training, testing or certification.

Conclusion: FRA determined that employee training, testing and certification did not contribute to the cause or severity of the accident.

Analysis- Train Make-up: Train 1 consisted of 143 cars of mixed freight cars in the following sequence: 4 head end locomotives, 24 loaded intermodal multi-platform cars, 2 loaded bulkhead flat cars, 2 loaded covered hopper cars, 2 DPU locomotives (approx. 5,700 feet from the head end) and 66 cars of mixed freight with 42 loads and 24 empties. Although the train was in compliance with current BNSF train make-up rules at the time of the derailment, BNSF System Special Instructions item 47 restricts any empty conventional car weighing less than 45 tons be placed ahead of trailing tonnage greater than 5,500 tons.

FRA's investigation of the train make-up centered on the 66 cars behind the DPU locomotives, as the first car to derail was the first (empty) car behind the DPU consist.

Behind the DPU locomotives was a block of 5 empty boxcars cars with an average car weight of 45 tons per car, followed by 61 cars of mixed freight with a combined trailing weight of approximately 6,900 tons.

Conclusion: While Train 1 was in compliance with BNSF train make-up rules, FRA determined the combined gross tonnage behind the block of five empty cars contributed to the cause of the derailment as entrain forces generated by the dynamic braking acting on the tonnage behind the empties, created lift forces that exceeded the weight of an empty car, causing that the wheels of the car to depart their normal running path on the rail. Cause code H504--Buffing or slack action excessive, train make-up.

Analysis – Train Handling: An interview with the crew confirmed the train was Positive Train Control (PTC) and Trip Optimizer (TO) equipped. The trip out of Belen until the point of the UDE was noted as good by both the engineer and the conductor.

A review of locomotive event recorder downloads and track profile revealed the train was running with the Distributed Power Unit (DPU) in synchronous mode with the lead consist. At the time of the derailment, the train was traveling at 11 mph and in Throttle Notch 4 on a .18 percent descending grade, while on tangent track when it experienced an UDE. The maximum authorized time table speed for this section of track is 70 mph.

The event recorder shows just prior to the derailment the engineer was in full dynamic brake; as the head end and DPU locomotives were retarding the train speed from the head end, the lighter block of cars was being squeezed between the heavier blocks of cars behind it, which created lift. Once the compression of the lighter block of cars reached a point where the lift exceeded the weight of the cars, the wheels on car BNSF 782042 were lifted from their running path on straight track, and an undetermined number of the trailing cars also derailed. When the Engineer later began throttling up, further trailing cars began to derail and damage the track as Train 1 began initiating movement after the stop.

Event recorder data shows the following timeline of the brake cycling prior to the derailment:

At 5:59:30 a.m., the train was traveling at 18 mph with full dynamic brakes applied. The Engineer was running on an Approach Signal, with traffic ahead. The Dynamic brake went from idle to full application in approximately 14 seconds.

At 6:00:43 a.m., the train begins to slow to a stop and the Engineer begins reducing the dynamic

brakes. The Engineer stated he felt nothing unusual, however, based on the POD and initial point of track damage, this is when the derailment occurred, unbeknownst to the crew. Speed of the train at this time was 4 mph.

At 6:01:45 a.m., the train begins moving with throttle in N1. The Engineer felt nothing unusual immediately.

At 6:02:06 a.m., the train reaches 11 mph and the Throttle is in N3. As the Engineer places the Throttle in N4, he feels a 'bump' and it repeats several times. The speed is now 6.8 mph; the Engineer throttles down to N3 due to the unusual slack action.

At 6:05:26 a.m., the train experiences an undesired emergency brake application, having traveled West approximately 2,500 feet from the last stop. The Conductor reported train in UDE to the Dispatcher. A mechanical person was in the area and came to aid the crew. Upon arriving, he discovered 29 cars derailed upright and approximately 2,800 feet of damaged track.

The train had initially slowed down from 26 mph to Stop, using maximum dynamic braking with no train air braking for pacing due to traffic congestion ahead on approach to Winslow Yard. This created high buff forces within the train at MP 278.5, which led empty cars behind the DPU locomotives to derail as Train 1 came to a stop. The Event Recorder on the lead unit showed a heavy dynamic brake application at this time, over the course of approximately 14 seconds. After seeing the signal ahead go from Stop to Approach, the engineer began to throttle up to advance into the next block. As the engineer throttled into Run 4, he felt a 'surge' in the train and backed off to Run 3, and the train began to slow itself down rapidly prior to the train experiencing a UDE. The train had pulled West approximately 2,500 feet. after the stop at MP 280.2. Inspection of the track damage revealed 2,800 feet of track damage. Evidence points to the amplification of in-train forces due to sudden heavy application of dynamic braking, which led to the wheel lift that derailed the first involved car, BNSF 782042. As the train was pulled West, this led to the derailment of 28 additional cars and the track damage.

Conclusion:FRA concluded that train handling was the probable cause of the derailment. FRA determined rapid application of dynamic brake was the probable cause of the incident, cause code H519 -- Dynamic Brake, too rapid adjustment.

Analysis - Track: The track through the accident area consisted of Continuous Welded Rail (CWR) on wooden ties. The class of track throughout the accident area is class 5, with a maximum speed of 70 mph for freight and 90 mph passenger. The rail size is 141 and 136, and ties were last installed in 2017. There was no evidence of missing or defective fasteners. Average tie spacing was 24 inches between tie centers. The track ballast is crushed granite.

A post-accident track inspection was conducted, and no defects were noted. This segment of track is inspected twice weekly by BNSF track inspectors and after a review of the railroad's track inspection records no defective conditions were identified in the area of the derailment.

Conclusion - Track: FRA determined track conditions did not contribute to the cause or severity of the incident.

Analysis – Signal and Train Control: FRA reviewed logs and records of one Hot Box detector traversed by Train 1, BNSF signal trouble logs and signal test records from MP 270.40 to MP 275.37, and BNSF's Computer Aided Dispatching (CAD) logs from West Hibbard for a 50-minute period prior to derailment.

Conclusion: FRA concluded signal and train control did not contribute to the cause or severity of the

derailment.

Analysis – Mechanical (Locomotives): Train 1 consisted of four head-end locomotives and two mid-train distributed power locomotives located between cars at lines 33 and 34.

FRA reviewed BNSF mechanical records for the locomotives and no mechanical or maintenance defects were noted.

Conclusion:FRA concluded the mechanical condition of the locomotives was not a factor in the derailment.

Analysis – Mechanical (Cars): Train 1 originated at Kansas City, Kansas, with 143 cars on July 4, 2020. FRA's records review indicate the train received a Class I Brake Test and mechanical inspection by qualified mechanical department inspectors at Kansas City on July 4, 2020 at 10:01 a.m., with no defective cars noted.

Train 1 received a subsequent Class 1A air brake test performed by the train crew at Belen during a crew change prior to departing Belen on July 6, 2020 at 9:41 p.m., with no defects recorded.

Conclusion: A review of the available documentation and records found no indications of defective equipment in Train 1 prior to the derailment and determined the pre-accident inspection and testing of the cars were not contributing factors in the derailment.

Analysis- Fatigue: FRA uses an overall effectiveness rate of 63 as the baseline for fatigue analysis. This is the level at which the risk of a human factors related accident is calculated to be equal to chance. Below this baseline, fatigue is not considered as probable for an employee. The higher the FAID score, the higher fatigue exposure. Any schedule that violates the overall effectiveness rate, violates the fatigue threshold on the date of the accident, or violates the fatigue threshold in the days leading up to the accident are considered to be at risk of fatigue contributing to the accident. The fatigue questionnaires and other evidence collected are also considered when making a fatigue determination. Software sleep settings vary according to information obtained from each employee. If an employee does not provide sleep information, FRA uses the default software settings.

Conclusion: FRA obtained fatigue-related information, including work history, for all train operating employees involved in this accident. Based on the evidence collected during the accident investigation, excessive fatigue risk was present, however given the type of accident, there is not a strong likelihood that fatigue may have contributed to the cause or severity of the accident, cause code H199--Employee physical condition.

Overall Conclusions

The derailment was caused by in-train buffing forces due to the rapid application of full dynamic braking, with no train air braking to supplement train braking, and slack not bunched. On July 24, 2020, BNSF issued a Safety Update on proper use of Dynamic Braking/Train Braking in response to several such incidents.

Probable Cause and Contributing Factors

FRA has concluded the probable cause of the accident was cause code H519 -- Dynamic Brake, too rapid adjustment.

Contributing to the cause of the derailment was a block of 5 empty cars placed ahead of a block of 6,900 trailing tons, cause code H504--Buffing or slack action excessive, train make-up and FRA fatigue analysis found fatigue was present in both the engineer and conductor which may have had a contributing effect,

cause code H199--Employee physical condition.