



***Federal Railroad Administration
Office of Railroad Safety
Accident and Analysis Branch***

***Accident Investigation Report
HQ-2019-1350***

***Union Pacific Railroad Company (UP) Derailment
Caliente, Nevada
July 10, 2019***

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 Wednesday, July 10, 2019, at 5:22 a.m., PDT, a westbound Union Pacific Railroad Company (UP) freight train, MNPWCB-08 (Train 1), traveling at a recorded speed of 35 mph, derailed 32 loaded bi-level autorack cars. The derailment occurred at Milepost (MP) 432.8 on the UP's Caliente Subdivision, Rocky Mountain Service Unit, 27 miles south of Caliente, Nevada. Caliente is located approximately 150 miles northeast of Las Vegas, Nevada. The train consisted of 5 locomotives, 3 on the head end and 2 cut-in mid-train as the Distributed Power Units (DPU), with 179 loads and 3 empties. Train 1 had 20,572 trailing tons and was 12,927 feet long.

No injuries or release of hazardous material occurred. The estimated monetary damage to mechanical equipment was \$2,801,390, and the damage to track and structures was \$203,764.

Weather at the time of the derailment was pre-dawn, clear skies and a temperature of 75° F.

The Federal Railroad Administration (FRA) investigation determined the probable cause of the accident was H504 -- buffing or slack action excessive, train make-up, the descending grade and track curvature.

TRAIN SUMMARY

1. Name of Railroad Operating Train #1 Union Pacific Railroad Company	1a. Alphabetic Code UP	1b. Railroad Accident/Incident No. 0719RM012
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GENERAL INFORMATION

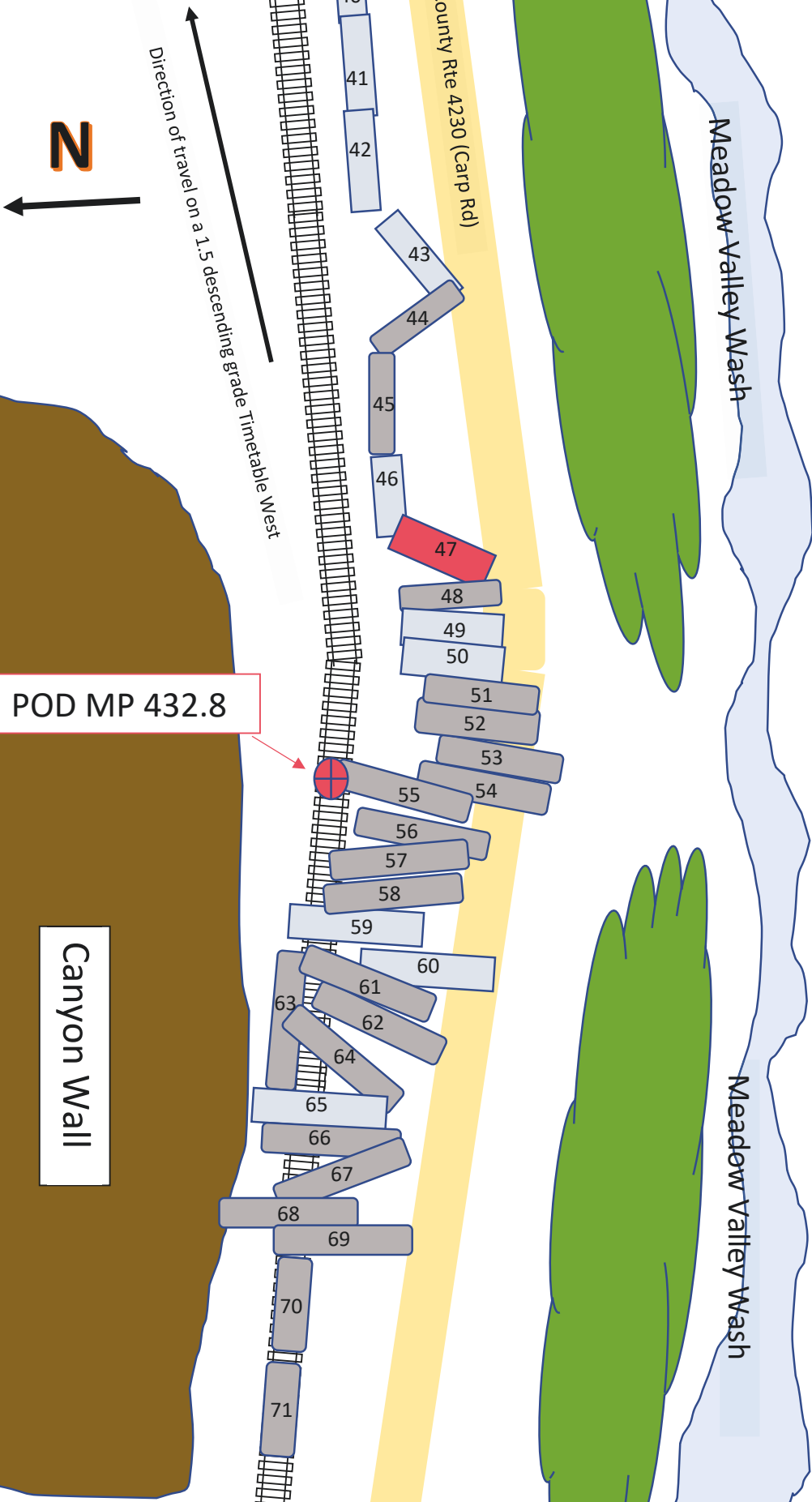
1. Name of Railroad or Other Entity Responsible for Track Maintenance Union Pacific Railroad Company	1a. Alphabetic Code UP	1b. Railroad Accident/Incident No. 0719RM012
2. U.S. DOT Grade Crossing Identification Number	3. Date of Accident/Incident 7/10/2019	4. Time of Accident/Incident 5:22 AM
5. Type of Accident/Incident Derailment		
6. Cars Carrying HAZMAT 0	7. HAZMAT Cars Damaged/Derailed 0	8. Cars Releasing HAZMAT 0
9. People Evacuated 0		
10. Subdivision UNION PACIFIC RAILROAD COMPANY - CALIENTE		
11. Nearest City/Town CALIENTE	12. Milepost (to nearest tenth) 432.8	13. State Abbr. NV
14. County LINCOLN		
15. Temperature (F) 75 °F	16. Visibility Dawn	17. Weather Clear
18. Type of Track Main		
19. Track Name/Number SINGLE MAIN TRACK	20. FRA Track Class Freight Trains-40, Passenger Trains-60	21. Annual Track Density (gross tons in millions) 41.4
22. Time Table Direction West		
23. PTC Preventable No	24. Primary Cause Code [H504] Buffing or slack action excessi	25. Contributing Cause Code(s)

OPERATING TRAIN #1

1. Type of Equipment Consist: Freight Train					2. Was Equipment Attended? Yes			3. Train Number/Symbol MNPWCB-08				
4. Speed (recorded speed, if available) R - Recorded 35.0 MPH E - Estimated		Code R	5. Trailing Tons (gross excluding power units) 20572		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>J, Q</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.)		TTGX 940788	47	yes				0	0			
(2) Causing (if mechanical, cause reported)		TTGX 940788	47	yes	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	3	0	2		0	0	(1) Total in Equipment Consist	179		0
(2) Total Derailed	0	0	0	0	0	(2) Total Derailed	32	0	0	0	0	
12. Equipment Damage This Consist 2801390			13. Track, Signal, Way & Structure Damage 203764									
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: 6 Mins: 27		19. Conductor Hrs: 6 Mins: 27		
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		25. Caboose Occupied by Crew?		N/A		
Nonfatal		0		0		0						
26. Latitude 37.300659000				27. Longitude -114.467364000								

Sketch - Caliente Sketch

HQ-2019-1350
Caliente, NV
07/10/19
5:22 a.m. PDT



Position from Headend	Derailed Cars	
40	TTGX	710709
41	TTGX	999091
42	TTGX	964375
43	TTGX	953269
44	TTGX	994673
45	TTGX	995916
46	CTTX	694232
47	TTGX	940788
48	TTGX	697499
49	TTGX	694824
50	GTW	504147
51	BNSF	301509
52	TTGX	965610
53	CP	542679
54	TTGX	704797
55	TTGX	982680
56	BNSF	301815
57	TTGX	603854
58	CTTX	694260
59	TTGX	993080
60	TTGX	994757
61	TTGX	978314
62	TTGX	985964
63	TTGX	887109
64	TTGX	697212
65	TTGX	978217
66	TTGX	996658
67	TTGX	702433
68	TTGX	712144
69	NKCR	7548
70	TTGX	978331
71	BNSF	301795

Rail Car Legend

- Car on side
- Car upright
- First causing car

Map 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 Pacific Daylight Time (PDT) unless otherwise indicated.

CIRCUMSTANCES PRIOR TO THE ACCIDENT

Union Pacific Railroad Company (UP) westbound freight train MNPWCB-08 (Train 1) was a mixed freight Key Train with three head end locomotives, two mid-train distributed power (DP) locomotives placed between lines 119 and 120, with 179 loaded cars and 3 empties for a total train length of 12,927 feet and 20,572 trailing tons. It departed North Platte, Nebraska, on July 8, 2019, 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 10:55 p.m., MDT, Tuesday, July 9, 2019, at Milford, Utah. This was the crew's home terminal and both had received their statutory required off-duty time. Upon arrival into Milford, the inbound crew performed the required Class 1A brake test. At the time of the crew swap, the outbound crew assisted with the release portion of the air test prior to relieving the inbound crew.

The derailment occurred at Milepost (MP) 432.8, on the UP Caliente Subdivision, Rocky Mountain Service Unit between stations Kyle and Leith, a remote canyon area approximately 27 miles south of the town of Caliente, Nevada. This location is a canyon wash with nearly 4,400 feet of elevation drop between Crestline (Milepost (MP) 497.6) and Moapa (MP 384.3). The maximum authorized speed for freight trains on the single main track in this area of the Caliente Subdivision is 35 mph, as prescribed by Caliente Subdivision Timetable No. 5, dated December 7, 2015. Timetable direction is west, and will be used throughout this report.

Train 1 departed Milford at approximately 12:55 a.m., MDT, July 10, 2019. The crew of Train 1 reported experiencing no issues prior to the derailment.

Weather at the time of the derailment was pre-dawn, clear skies and a temperature of 75° F.

THE ACCIDENT

At approximately 5:22 a.m., PDT, the train was traveling at 35 mph in full dynamic brake on a 1.5-percent descending grade while traversing nine left- and right-hand curves ranging from 4 degrees to 8 degrees between MP 436 and the POD at MP 432.8 when an undesired emergency (UDE) brake application occurred that brought the train to a stop. The crew stated they did not experience run-in due to slack action and that led the crew to believe they probably had an air hose separation that caused the undesired emergency brake application. The conductor performed a walking inspection of Train 1 and secured the hand brakes, which is the procedure following an emergency application on this grade of track. While performing the walking inspection, the crew received a radio transmission from a signal maintainer in the area who told the crew they had cars derailed in their train. The engineer informed the dispatcher of the derailment, and a further inspection revealed 32 loaded bi-level autorack rail cars, lines 40 to 71 from the head end, had derailed.

No injuries or release of hazardous material occurred. The estimated monetary damage to mechanical equipment was \$2,801,390, and the damage to track and structures was \$203,764.

POST-ACCIDENT INVESTIGATION

On July 11, 2019, the Federal Railroad Administration (FRA) began an investigation of this accident.

After the on-site inspection and investigation, FRA investigators requested all necessary event recorder downloads, dispatcher audio files, records, forms, and other documentation necessary to conduct the final analysis and conclusion concerning the facts of the accident.

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

ANALYSIS AND CONCLUSIONS

Analysis -- Operating Practices/Train Handling: A review of crewmember records revealed no exceptions with their training, testing, certification, or hours of service records.

An interview with the crew confirmed Train 1 was Positive Train Control (PTC) and Trip Optimizer (TO) equipped; however, due to the train length and undulating terrain, the TO could not maintain speed control and was disengaged. PTC was engaged at the time of the accident and operating as intended. 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 and the engineer was using a balance of dynamic brakes and air brakes to control the speed. At the time of the derailment, the train was traveling at 35 mph, and in full dynamic brake on a 1.5-percent descending grade, while traversing a series of 9 left- and right-hand curves.

The use of balanced braking results in the Engineer cycling between dynamic brakes and air brakes and can increase the buffing forces within a train. This method is necessary; however, due to the train's length and the undulating terrain, the same conditions prevented the TO from remaining engaged. FRA's investigation concluded the train handling was compliant with all carrier train-handling rules and Federal regulations and, although buffing forces were generated during train handling, it was the amplification of these in-train forces due to train make-up which led to the wheel lift that derailed the first involved car, TTGX 940788.

Conclusion: FRA concluded that crew training, qualifications, or train handling did not contribute to the cause or severity of the derailment.

Analysis - Track: The track through the accident area consisted of Continuous Welded Rail (CWR) on concrete ties with a Pandrol "Safelok-I" driven clip fastening system. The rails on the curved track were 141-pound, HH VT Nippon rail. The high-side rail was manufactured in April 2007 and the low side rail was manufactured in March 2005. No evidence existed of missing or defective fasteners. No excessive rail seat abrasion was found. Average tie spacing was 24 inches between tie centers. The track ballast is crushed granite. The tie cribs appeared to be full with an average of 18 to 24 inches of shoulder ballast.

A post-accident track inspection was conducted and no defects were noted. This segment of track is inspected twice weekly by UP 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 derailment.

Analysis – Signal and Train Control: FRA reviewed logs and records of the three Hot Box detectors traversed by the train, UP signal trouble logs and signal test records from C434 West Kyle to C430 East

Leith, and UP's Computer Aided Dispatching (CAD) logs from West Kyle to East Leith for a 24-hour period prior to derailment. No conditions were found that would have affected the operation of Train 1.

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

Analysis – Mechanical (Locomotives): UP Train MNPWCB-08 consisted of three head-end locomotives and two mid-train distributed power locomotives located between cars at lines 119 and 120.

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

Conclusion: FRA determined the mechanical condition of the locomotives did not contribute to the cause or severity of the derailment.

Analysis – Mechanical (Cars): UP Train MNPWCB-08 originated at North Platte, Nebraska, with 182 cars on July 8, 2019. FRA's records review indicate Train 1 received a Class I Brake Test and mechanical inspection by qualified mechanical department inspectors at North Platte on July 8, 2019 at 12:10 a.m., CDT, with no defective cars noted.

Train 1 received a subsequent Class 1A air brake test performed by the train crew at Milford, Utah, during a crew change prior to departing Milford on July 10, 2019 at 12:55 a.m., MDT, with no defects recorded. A review of the documentation and records found no indications of defective equipment in Train 1 prior to the derailment.

Conclusion: FRA determined the mechanical condition of the cars did not contribute to the cause or severity of the derailment.

Analysis- Train Make-up: Train 1 consisted of 182 cars of mixed freight in the following breakout: 3 head end locomotives, 119 loaded cars -- primarily tank and autorack-type cars -- of which 47 were cushioned drawbar equipped, 2 DPUs, and 63 cars of mixed freight with 11 cars cushioned drawbar-equipped. The train was in compliance with current UP train make-up rules at the time of the derailment.

FRA's investigation of the train make-up centered on the 119 cars between the lead locomotive consist and the DPU locomotives, which significantly impacted the weight distribution and accumulative free travel within the train.

Autorack cars are equipped with cushioned drawbars. The draft gear travel on these drawbars is 10 inches with an additional 2 to 3 inches in component wear. Using 23 inches of travel as an average per cushioned equipped car, a block of 43 cars can have up to 82 feet of free travel within that block of cars. Additionally, the autorack cars were much lighter than the cars ahead of and behind them which created a distributional imbalance in the overall mass of these 119 cars, as follows: behind the lead locomotive was a block of 33 cars with an average car weight of 124.9 tons per car, followed by the 43 autorack cars with an average car weight of 72.1 tons, and finally a block of 43 cars with an average weight of 134.4 tons per car followed by the distributed power locomotives.

The event recorder shows just prior to the derailment the engineer was in full dynamic brake, the head end locomotives were retarding the train speed from the head end and the lighter block of autorack cars were being squeezed between the heavier blocks of cars ahead and 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, a wheel on car TTX 940788 was lifted from its running path in a curve that resulted in the derailment.

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

At 5:19:27 a.m., Train 1 was traveling at 35 mph with full dynamic brakes applied. The Engineer made a minimum air brake set to slow the train.

At 5:19:47 a.m., Train 1 begins to slow with the addition of the air brakes and the Engineer begins reducing the dynamic brakes.

At 5:21:22 a.m., Train 1's speed is 32 mph and slowing with the air brake set and the dynamic brakes at a minimum. At this point, all the cars would be bunched together in the train. To prevent further slowing of the train, the Engineer released the air brakes.

At 5:21:30 a.m., Train 1's speed is 31 mph; however, the brake pipe pressure at the head end of the train is 89 psi that fully released the head end brakes but the brake pipe pressure at the rear end of the train is 81 psi which prevented the brakes from releasing toward the rear of the train. This allowed the free travel within the cushioned drawbar-equipped autorack cars near the head end of the train to stretch out on the descending grade.

At 5:22:06 a.m., the brakes are fully released throughout the train and the speed is 33 mph; the Engineer is approaching full dynamic brakes on the locomotives to arrest the increasing speed of the train.

At 5:22:24 a.m., Train 1's speed is 35 mph and the engineer is in full dynamic brakes.

At 5:22:35 a.m., Train 1 experienced an undesired emergency brake application resulting from a car derailing in the train. The slowing of the train with the dynamic brakes induced buff forces in the train. These buff forces were amplified due to the cushioned drawbar-equipped autorack cars that had stretched out during the cycle between the use of air brakes and dynamic brakes. As the dynamic brakes retarded the speed of the train from the head end, the cars began bunching up with the block of lighter weight auto-rack cars squeezed between the heavier tonnage of the cars behind them. This action created enough wheel lift on car TTGX 940788 that the wheel flange climbed the rail in a curve and derailed the train.

Conclusion: FRA determined the train make-up was the probable cause of the derailment. (Cause code H504)

Analysis- Toxicological Testing: The accident met the criteria for Title 49 Code of Federal Regulations (CFR) Part 219, Subpart C Post Accident Toxicological Testing. The Engineer and Conductor were both tested under FRA guidelines for the use of alcohol and drugs with negative results.

Conclusion: FRA determined drug and alcohol use did not contribute to the cause or severity of the derailment.

OVERALL CONCLUSIONS

The derailment was caused by in-train buffing forces due to the placement of a block of 43 autorack cars with significant trailing tonnage behind their block. These forces were amplified during braking on this terrain of descending grades and multiple curves.

Following the accident, UP modified its System Special Instruction train placement restrictions for autoracks/flat cars 90 feet or longer and weighing 80 tons or less. The current change now requires autoracks/flat cars 90 feet or longer and weighing 80 tons or less, when combined with other equipment, continuous blocks of 20 or more autoracks/flat cars are to be placed within the rear 5,500 trailing tons of the train. Previously, the only restriction on the number of autoracks in a train restricted the train length to 80 cars if there were more than 60 autorack cars.

PROBABLE CAUSE AND CONTRIBUTING FACTORS

The FRA investigation determined the probable cause of the accident was H504 -- buffing or slack action excessive, train make-up, the descending grade and track curvature.

No contributing factors were identified.