Federal Railroad Administration
Office of Safety
Headquarters Assigned
Accident Investigation Report
HQ-2006-46

Union Pacific
Morrison, Missouri
June 10, 2006

Note that 49 U.S.C. §20903 provides that no part of an accident or incident report 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.

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION

FRA FACTUAL RAILROAD ACCIDENT REPORT

FRA File # HQ-2006-46

1.Name of Railroad Operating Train #1: Union Pacific RR Co. [UP]	1a. Alphabetic Code: UP	1b. Railroad Accident/Incident No.: 0606SL006
2.Name of Railroad Operating Train #2: N/A	2a. Alphabetic Code: N/A	2b. Railroad Accident/Incident: N/A
3.Name of Railroad Responsible for Track Maintenance: Union Pacific RR Co. [UP]	3a. Alphabetic Code: UP	3b. Railroad Accident/Incident No.: 0606SL006
4. U.S. DOT_AAR Grade Crossing Identification Number:	5. Date of Accident/Incident: Month 06 / Day 10 / Year 2006	6. Time of Accident/Incident: 07:00: ☑ AM ☐ PM

7. Type of Accident/Indicent (single entry in code box): 1. Derailment; 2. Head on collision; 3. Rear end collision; 4. Side collision; 5. Raking collision; 6. Broken Train collision; 7. Hwy-rail crossing; 8. RR grade crossing; 9. Obstruction; 10. Explosion-detonation; 11. Fire/violent rupture; 12. Other impacts; 13. Other (describe in narrative): 01

8. Cars Carrying HAZMAT	9. HAZMAT Cars Damaged/Derailed	10. Cars Releasing HAZMAT	11. People Evacuated	12. Division
4	2	0	0	St Louis

13. Nearest City/Town	14. Milepost (to nearest tenth)	15. State Abbr	15. State Code	16. County
Morrison	94.2	N/A	MO	OSAGE

17. Temperature (F) (specify if minus)	18. Visibility (single entry) 1. Dawn 2. Day 3.Dusk 4.Dark	Code	19. Weather (single entry) 1. Clear 2. Cloudy 3. Rain 4. Fog 5.Sleet 6.Snow	Code	20. Type of Track 1. Main 2. Yard 3. Siding 4. Industry	Code
80 F		2		1		1

21. Track Name/Number	22. FRA Track Class (1-9, X)	Code	23. Annual Track Density (gross tons in millions)	24. Time Table Direction 1. North 3. East	Code
No. 2 Main		4	77		3

OPERATING TRAIN #1

25. Type of Equipment Consist (single entry) 1. Freight train 2. Passenger train 3. Commuter train 4. Work train 5. Single car 6. Cut of cars 7. Yard/switching 8. Light loco(s). 9. Maint./inspect.car	A. Spec. MoW Equip.	Code	26. Was Equipment Attended? 1. Yes 2. No	Code	27. Train Number/Symbol
		1	1	1	MKCA S 09

28. Speed (recorded speed, if available) R - Recorded E - Estimated			Code	30. Method(s) of Operation (enter code(s) that apply)	30a. Remotely Controlled Locomotive?
E - Estimated	15	MPH	E	a. ATCS; b. Auto train control; c. Auto train stop; d. Cab; e. Traffic; f. Interlocking; g. Automatic block; h. Current of traffic; i. Time table/train orders; j.Track warrant control; k. Direct traffic control; l.Yard limits; m.Special instructions; n. Other than main track; o. Positive train control; p. Other (Specify in narrative)	0 = Not a remotely controlled; 1 = Remote control portable; 2 = Remote control tower; 3 = Remote control transmitter - more than one remote control transmitter: 0

29. Trailing Tons (gross tonnage, excluding power units): 6159

Code(s): j | N/A | N/A | N/A | N/A

31. Principal Car/Unit	a. Initial and Number	b. Position in Train	c. Loaded (yes/no)
(1) First involved (derailed, struck, etc)	N/A	32	no
(2) Causing (if mechanical cause reported)	N/A	N/A	N/A

32. If railroad employee(s) tested for drug/alcohol use, enter the number that were positive in the appropriate box.

Alcohol	Drugs
0	0

33. Was this consist transporting passengers? (Y/N): N

34. Locomotive Units	a. Head End	Mid Train b. Manual	Mid Train c. Remote	Rear End d. Manual	Rear End c. Remote
(1) Total in Train	5	0	0	0	0
(2) Total Derailed	0	0	0	0	0

35. Cars	Loade a. Freight	Loade b. Pass.	Empty c. Freight	Empty d. Pass.	e. Caboose
(1) Total in Equipment Consist	32	0	61	0	0
(2) Total Derailed	5	0	15	0	0

36. Equipment Damage This Consist	37. Track, Signal, Way, & Structure Damage	38. Primary Cause Code	39. Contributing Cause Code
68761	156730	H519	H504

Number of Crew Members

40. Engineer/ Operators	41. Firemen	42. Conductors	43. Brakemen
N/A	0	1	0

Length of Time on Duty

44. Engineer/Operator	45. Conductor
Hrs 3 Mi 0	Hrs 3 Mi 0

Casualties to:	46. Railroad Employees	47. Train Passengers	48. Other
Fatal	0	0	0
Nonfatal	N/A	0	0

49. EOT Device? 1. Yes 2. No: 1

50. Was EOT Device Properly Armed? 1. Yes 2. No: 1

51. Caboose Occupied by Crew? 1. Yes 2. No: N/A

OPERATING TRAIN #2

52. Type of Equipment Consist (single entry) 1. Freight train 2. Passenger train 3. Commuter train 4. Work train 5. Single car 6. Cut of cars 7. Yard/switching 8. Light loco(s). 9. Maint./inspect.car	A. Spec. MoW Equip.	Code	53. Was Equipment Attended? 1. Yes 2. No	Code	54. Train Number/Symbol
		N/A	N/A	N/A	N/A

55. Speed (recorded speed, if available) R - Recorded E - Estimated			Code	57. Method(s) of Operation (enter code(s) that apply)	57a. Remotely Controlled Locomotive?
E - Estimated	0	MPH	N/A	a. ATCS; b. Auto train control; g. Automatic block; h. Current of traffic; m.Special instructions; n. Other than main track	0 = Not a remotely controlled; 1 = Remote control portable

DEPARTMENT OF TRANSPORTATION
FEDERAL RAILROAD ADMINISTRATION

FRA FACTUAL RAILROAD ACCIDENT REPORT

FRA File # HQ-2006-46

56. Trailing Tons (gross tonnage, excluding power units): N/A

c. Auto train stop; d. Cab; e. Traffic; f. Interlocking; i. Time table/train orders; j.Track warrant control; k. Direct traffic control; l.Yard limits; o. Positive train control; p. Other (Specify in narrative)

Code(s): N/A | N/A | N/A | N/A | N/A

2 = Remote control tower
3 = Remote control transmitter - more than one remote control transmitter: N/A

58. Principal Car/Unit	a. Initial and Number	b. Position in Train	c. Loaded (yes/no)
(1) First involved (derailed, struck, etc)	0	N/A	N/A
(2) Causing (if mechanical cause reported)	0	N/A	N/A

59. If railroad employee(s) tested for drug/alcohol use, enter the number that were positive in the appropriate box.

Alcohol	Drugs
N/A	N/A

60. Was this consist transporting passengers? (Y/N): N/A

61. Locomotive Units	a. Head End	Mid Train b. Manual	Mid Train c. Remote	Rear End d. Manual	Rear End c. Remote
(1) Total in Train	0	0	0	0	0
(2) Total Derailed	0	0	0	0	0

62. Cars	Loade a. Freight	Loade b. Pass.	Empty c. Freight	Empty d. Pass.	e. Caboose
(1) Total in Equipment Consist	0	0	0	0	0
(2) Total Derailed	0	0	0	0	0

63. Equipment Damage This Consist: 0

64. Track, Signal, Way, & Structure Damage: 0

65. Primary Cause Code: N/A

66. Contributing Cause Code: N/A

Number of Crew Members

67. Engineer/ Operators	68. Firemen	69. Conductors	70. Brakemen
N/A	N/A	N/A	N/A

Length of Time on Duty

71. Engineer/Operator: Hrs 0 Mi 0

72. Conductor: Hrs 0 Mi 0

Casualties to:	73. Railroad Employees	74. Train Passengers	75. Other
Fatal	0	0	0
Nonfatal	0	0	0

76. EOT Device? 1. Yes 2. No: N/A

77. Was EOT Device Properly Armed? 1. Yes 2. No: N/A

78. Caboose Occupied by Crew? 1. Yes 2. No: N/A

Highway User Involved

79. Type: A. Auto; B. Truck; C. Truck-Trailer.; D. Pick-Up Truck; E. Van; F. Bus; G. School Bus; H. Motorcycle; J. Other Motor Vehicle; K. Pedestrian; M. Other (spec. in narrative) — Code: N/A

80. Vehicle Speed (est. MPH at impact): N/A

81. Direction geographical) 1.North 2.South 3.East 4.West — Code: N/A

82. Position: 1.Stalled on Crossing 2.Stopped on Crossing 3.Moving Over Crossing 4. Trapped — Code: N/A

86a. Was the highway user and/or rail equipment involved in the impact transporting hazardous materials? 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: N/A

Rail Equipment Involved

83. Equipment: 1.Train(units pulling); 2.Train(units pushing); 3.Train (standing); 4.Car(s) (moving); 5.Car(s) (standing); 6.Light Loco(s) (moving); 7.Light(s) (standing); 8.Other (specify in narrative) — Code: N/A

84. Position of Car Unit in Train: N/A

85. Circumstance: 1. Rail Equipment Struck Highway User; 2. Rail Equipment Struck by Highway User — Code: N/A

86b. Was there a hazardous materials release by 1. Highway User 2. Rail Equipment 3. Both 4. Neither — Code: N/A

86c. State here the name and quantity of the hazardous materials released, if any.
N/A

87. Type of Crossing Warning: 1.Gates; 2.Cantilever FLS; 3.Standard FLS; 4.Wig Wags; 5.Hwy. traffic signals; 6.Audible; 7.Crossbucks; 8.Stop signs; 9.Watchman; 10.Flagged by crew; 11.Other (spec. in narr.); 12.None

Code(s)							
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

88. Signaled Crossing Warning (See instructions for codes) — Code: N/A

89. Whistle Ban 1. Yes 2. No 3. Unknown — Code: N/A

90. Location of Warning 1. Both Sides 2. Side of Vehicle Approach 3. Opposite Side of Vehicle Approach — Code: N/A

91. Crossing Warning Interconnected with Highway Signals 1. Yes 2. No 3. Unknown — Code: N/A

92. Crossing Illuminated by Street Lights or Special Lights 1. Yes 2. No 3. Unknown — Code: N/A

93. Driver's Age: N/A

94. Driver's Gender 1. Male 2. Female — Code: N/A

95. Driver Drove Behind or in Front of Train and Struck or was Struck by Second Train 1. Yes 2. No 3. Unknown — Code: N/A

96. Driver 1. Drove around or thru the Gate 2. Stopped and then Proceeded 3. Did not Stop 4. Stopped on Crossing 5. Other (specify in narrative) — Code: N/A

97. Driver Passed Standing Highway Vehicle 1. Yes 2. No 3. Unknown — Code: N/A

98. View of Track Obscured by (primary obstruction) 1. Permanent Structure 2. Standing Railroad Equipment 3. Passing Train 4. Topography 5. Vegetation 6. Highway Vehicle 7. Other (specify in narrative) 8. Not obstructed — Code: N/A

101. Casulties to Highway-Rail Crossing Users	Killed	Injured
	N/A	N/A

99. Driver Was 1. Killed 2.Injured 3. Uninjured — Code: N/A

100. Was Driver in the Vehicle? 1. Yes 2. No — Code: N/A

102. Highway Vehicle Property Damage (est. dollar damage): N/A

103. Total Number of Highway-Rail Crossing Users (include driver): N/A

104. Locomotive Auxiliary Lights? 1. Yes 2. No — Code: N/A

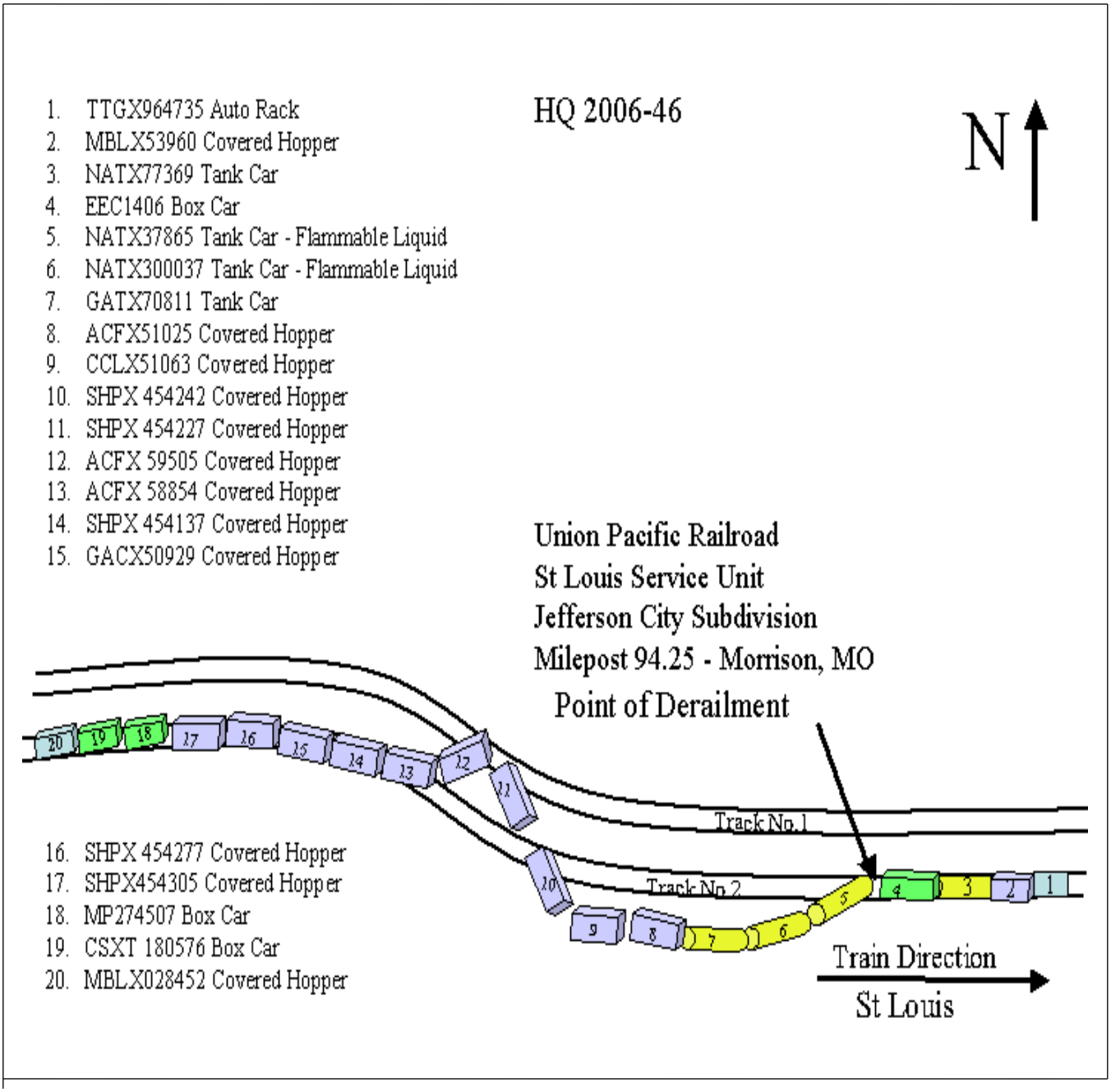
105. Locomotive Auxiliary Lights Operational? 1. Yes 2. No — Code: N/A

106. Locomotive Headlight Illuminated? 1. Yes 2. No — Code: N/A

107. Locomotive Audible Warning Sounded? 1. Yes 2. No — Code: N/A

108. DRAW A SKETCH OF ACCIDENT AREA INCLUDING ALL TRACKS, SIGNALS, SWITCHES, STRUCTURES, OBJECTS, ETC., INVOLVED.

HQ-2006-46.bmp



109. SYNOPSIS OF THE ACCIDENT

Synopsis of Accident

Eastbound Union Pacific Railroad Company (UP) freight Train Symbol MKCAS 09 derailed on June 10, 2006, at 7 a.m., near Morrison, Missouri, on Main Track No. 2, at UP Milepost (MP) 94.2, on the St. Louis Division, Jefferson City Subdivision. Morrison is located about 100 miles west of St. Louis, Missouri. Timetable directions used for this report are east and west.

There were no injuries. Three rail tank cars were derailed without release of product. There was no evacuation. Damages were $68,761 to equipment and $156,730 to track.

At the time of the accident it was daylight and clear. The temperature was 80 °F.

The eastbound train stopped to wait for a westbound train to clear single main track at Morrison Junction. Locomotive event recorder data indicates the use of dynamic braking was improper due to rapid adjustment, causing the slack to run in. The run-in caused the leading end of the 32nd head car, Car No. EEC1406, to derail. There was no inspection of the train conducted after the stop by the crew. The train was pulled about 1,200 feet east, resulting in the derailment of the 29th through 48th head cars. All derailed rail cars remained in the upright position.

The crew was required to submit to UP Reasonable Cause testing. All results were negative.

The primary cause is Train Handling, cause code H519 - Use of Dynamic Brake, too rapid adjustment. The Train Simulator revealed that maximum steady-state buff forces were excessive, in the range of 500,000 to 700,000 lbs., although train make-up was in compliance with UP System Special Instructions. A contributing factor should be recorded as H504 - buffing action excessive, train make-up.

110. NARRATIVE

The following information was obtained from an investigation that was conducted by the Federal Railroad Administration.

Circumstances Prior to the Accident

The UP conductor and locomotive engineer went on duty at their away-from-home terminal at Jefferson City, Missouri, on June 10, 2006, at 4 a.m. c.d.t., to perform duties on Train Symbol MKCAS 09. They were fully rested, having a period of release at Jefferson City in excess of 15 hours, prior to going on duty. Train Symbol MKCAS 09 consisted of 32 loads, 61 empties, 6,159 tons, and was 7,139 feet in length. It was scheduled to operate from Jefferson City to their home terminal of Dupo, Illinois.

Shortly after going on duty, the train crew conducted a job briefing to discuss train documents, including their track bulletins and train consist. All documentation was correct and accounted for. Train Symbol MKCAS 09 had no cars scheduled to be set out or picked up between Jefferson City and Dupo. The Class I brake test-initial terminal inspection slip was in the cab of the locomotive, which had been completed in Kansas City, Missouri. The inbound locomotive engineer informed the outbound crew that there were no problems with the train and the dynamic brakes were operating properly. At about 4:27 a.m., the outbound crew boarded their train and the engineer observed that five locomotive units were operating. He shut down the rear two units for fuel conservation, leaving the three lead units on-line. The calendar day inspection had been completed on the previous day in Kansas City. The train was composed of mixed freight, including 28 empty auto racks. They departed Jefferson City at about 4:41 a.m.

The train handled without any unusual events until the area of derailment. The lead locomotive was equipped with an audible alertness device, which was working properly. The headlight, horn, and whistle were functioning properly.

Approaching the derailment site at Morrison, the train was operating eastward on Main Track No. 2. It was daylight and the weather was clear and warm. The locomotive engineer was seated at the controls in the cab of the lead locomotive (short end forward) on the right-hand side, and the conductor was seated on the left-hand side of the cab.

The last signal observed by the crew was an Approach indication displaying a single yellow aspect at MP 94.8, at 6:24 a.m. A “Form A” Slow Order with a maximum speed allowance of 25 mph was in effect from MP 95.7 to MP 91.0. The train was operated through this area at a speed of about 17 to18 mph while proceeding through three successive curves; the first being a right-hand curve of 1-degree 58-minutes, the second a left-hand curve of 1-degree 0-minutes, and then a right-hand curve of 1-degree 57-minutes. The track is on level grade in this area.

The locomotive engineer, preparing to stop short of the farm crossing at MP 93.7, utilized the train's dynamic braking to slow the train. He first placed the throttle into the idle position, waited 10 seconds, then placed the dynamic brake into Position No. 1, then Position No. 2, then Position No. 3. He felt the train was slowing too rapidly and repositioned the dynamic brake to Position No. 2 to let the train speed increase. He then initiated a minimum reduction of 4 lbs. of the train air brakes to begin stop, and then initiated a full application of 10 lbs. to complete stop, where the train was stopped short of the farm crossing located at MP 93.7. As this stop was being accomplished, westbound Train Symbol KMNOA 09 passed on the Main Track No. 1. The passing train crew informed the crew of Train Symbol MKCAS 09 that their train looked good and gave a "high ball". The crew did not feel any buff forces or run-in while stopping and there was no undesired emergency application of the train air brakes. At this point, the crew had no indication that any cars in their train were derailed.

The Derailment

The initial derailment of the leading wheels of the 32nd head car occurred during the stopping of the train, as a result of heavy run-in. At about 6:58 a.m., the engineer started to operate the train eastward once again. He initially placed the throttle handle to Position No. 1, then Position No. 2, then Position No. 3, before the train started moving. After moving approximately 1,200 feet, operating to a maximum speed of 9 mph, the engineer felt a sharp hard tug from the train and he stopped the movement. After the stop the train air brake system started to draw down to zero lbs., resulting in an undesired emergency application of the train air brake system. The locomotive engineer instructed the conductor to walk back and inspect the train. The conductor reported back that they had cars derailed, beginning with the 29th head car. Approximately 20 rail cars had derailed, with some fouling Main Track No. 1. The locomotive engineer immediately contacted the UP train dispatcher and informed him of the derailed cars and that they were fouling Main Track No. 1.

The maximum authorized speed for the track segment between Jefferson City to Dupo is 50 mph, but a “Form A” Slow Order with a maximum speed allowance of 25 mph was in effect from MP 95.7 to MP 91.0,

Analysis and Conclusion

Locomotive Event Recorder Data

A printout of the locomotive event recorder download of lead Locomotive No. UP 2386 was obtained and reviewed. The following information was determined from review of the locomotive event recorder data:

Train Symbol MKCAS 09 operated within the authorized speed limitations prior to, and at the time of, the accident.

Train Symbol MKCAS 09 initiated movement eastbound from Jefferson City at MP 125.0 at 4:41 a.m. The train continued operating eastward, stopping at MP 104.85 at 5:30 a.m., for a delay of about 5-minutes 30-seconds.

Train Symbol MKCAS 09 was then operated eastward, leaving MP 104.85 at 5:31 a.m., and continuing to MP 98.88, stopping at 5:52 a.m., for a 2-minute 10-second delay. It then departed MP 98.88 at 5:54 a.m., stopping at MP 97.1 at 6:08 a.m., for a 7-minute 30-second delay. It then departed MP 97.1 at 6:15 a.m., and operated about 3 miles, with maximum speed not exceeding 24 mph. The elapsed time of movement was about 6- minutes 27-seconds until the run-in began at 6:26 a.m., at MP 93.84. A period of 1-minute 8-seconds elapsed from the run-in to stop. In this time frame, the leading wheels of the 32nd head car, Car No. EEC1406, derailed.

The event recorder data did record a rapid adjustment of the locomotive dynamic braking, which resulted in an undulation of speed from 19 mph to 15 mph then to 18 mph within 12 seconds, and a rapid spike in amperage with an increase of 322 amps within the same 12-second period.

As Train Symbol MKCAS 09 was stopping, it was passed by westbound Train Symbol KMNOA 09. Train Symbol MKCAS 09 was stopped at this location for about 28 minutes. The locomotive engineer started pulling at 6:55 a.m., for a distance of 1,259 feet, with an elapsed time of about 2-minutes 50-seconds. The locomotive engineer noticed the train was hard to pull. He then placed the throttle in Position No. 1, then to Position No. 4, changed back to Position No. 3, and then back to Position No. 4 for 28 seconds, loading 674 amps. He then moved the throttle to Position No. 5 at 6:57 a.m., for about 38 seconds, pulling 813 amps; then notched down from Position No. 5 to Position No. 1, and then to the throttle “off” position within 3 seconds, which added to the run-in. The train stopped at 6:58 p.m. After the slack ran in, an emergency application of the train’s air brake system resulted, tripping the PCS valve within a minute of the stop.

Interviews of crew of Train Symbol MKCAS 09

Interviews with the crew indicated that, as the initial stop was made at Morrison, they did not feel any abnormal run-in of the train. There was also no undesired emergency application of the train’s air brake system. After the initial stop they were not aware of any derailed cars and had no indication they should walk or inspect the train.

Review of Train Consist and Make-up

Review of the train consist determined compliance with current UP System Special Instructions -Train Make-Up requirements. Although complying with UP train consist and make-up rules, the tonnage graph of Train Symbol MKCAS 09 indicates that the preponderance of the weight was distributed from the 51st to 72nd cars of the 93-car train.

Train Simulator Review

FRA requested that Train Symbol MKCAS 09 be loaded in the UP Train Simulator and operated under the same scenario as on the date of the derailment. The simulation verified the locomotive engineer did use dynamic braking and the use was improper due to rapid adjustment, causing the slack to run-in. In running the simulation it was also found that in steady-state dynamic braking with all slack run-in, there were heavy amounts of buff forces, with as much as 500,000 to 700,000 lbs. of buff forces acting on the train.

Confirmation was made with the UP to determine if Train Symbol MKCAS 09 was correctly set up in the Train Simulator with three locomotives. It was determined the train was input correctly. A simulation was also run on the exact same train consist with three SD70 locomotives instead of three Dash-44 locomotives. The results were the same with 500,000 to 700,000 lbs. of maximum steady-state buff forces.

FRA requested that a train of similar weight, with weight distributed more evenly throughout the train, similar length, and with three SD70 locomotives, under the same operating conditions as Train Symbol MKCAS 09, be run on the Train Simulator. The simulation of a train with more equal weight distribution resulted with maximum steady-state buff forces of only 215,380 lbs.

Probable Cause & Contributing Factors

An investigation by the Federal Railroad Administration found that a contributing factor was H504 - buffing action excessive, train make-up.

The FRA found the primary cause to be Train Handling, cause code H519 - Use of Dynamic Brake, too rapid adjustment. The Train Simulator revealed that maximum steady-state buff forces were excessive, in the range of 500,000 to 700,000 lbs., although train make-up was in compliance with UP System Special Instructions.