Federal Railroad Administration
Office of Safety
Headquarters Assigned
Accident Investigation Report
HQ-2006-27

Norfolk Southern (NS)
Radebaugh, Pennsylvania
May 3, 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-2006-27

1.Name of Railroad Operating Train #1: Norfolk Southern Corp. [NS]	1a. Alphabetic Code: NS	1b. Railroad Accident/Incident No.: 25031
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: Norfolk Southern Corp. [NS]	3a. Alphabetic Code: NS	3b. Railroad Accident/Incident No.: N/A
4. U.S. DOT_AAR Grade Crossing Identification Number	5. Date of Accident/Incident: Month 05 / Day 03 / Year 2006	6. Time of Accident/Incident: 12:01:00 ☑ 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
0	0	0	0	Pittsburgh

13. Nearest City/Town	14. Milepost (to nearest tenth)	15. State Abbr	15. State Code	16. County
Jeannette, PA	PT 325.2	N/A	PA	WESTMORELAND

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
46 F		4		2		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
#2 Main / #1		4	52		4

OPERATING TRAIN #1

25. Type of Equipment Consist (single entry)	A. Spec. MoW Equip.	Code	26. Was Equipment Attended? 1. Yes 2. No	Code	27. Train Number/Symbol
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		1	1	1	72NC20

28. Speed (recorded speed, if available) R - Recorded / E - Estimated: 40 MPH — Code: R

29. Trailing Tons (gross tonnage, excluding power units): 7661

30. Method(s) of Operation (enter code(s) that apply)
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)
Code(s): d | N/A | N/A | N/A | N/A

30a. Remotely Controlled Locomotive?
0 = Not a remotely controlled; 1 = Remote control portable; 2 = Remote control tower; 3 = Remote control transmitter - more than one remote control transmitter: 0

31. Principal Car/Unit	a. Initial and Number	b. Position in Train	c. Loaded (yes/no)
(1) First involved (derailed, struck, etc)	N/A	01	N/A
(2) Causing (if mechanical cause reported)	NS6600	99	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	2	0	0	2	0
(2) Total Derailed	2	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	59	0	0	0	0
(2) Total Derailed	30	0	0	0	0

36. Equipment Damage This Consist	37. Track, Signal, Way, & Structure Damage	38. Primary Cause Code	39. Contributing Cause Code
585184	145000	E99L	H218

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 6 Mi 1	Hrs 6 Mi 1

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)	A. Spec. MoW Equip.	Code	53. Was Equipment Attended? 1. Yes 2. No	Code	54. Train Number/Symbol
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		N/A	N/A	N/A	N/A

55. Speed (recorded speed, if available) R - Recorded / E - Estimated: 0 MPH — Code: N/A

57. Method(s) of Operation (enter code(s) that apply)
a. ATCS; b. Auto train control; g. Automatic block; h. Current of traffic; m.Special instructions; n. Other than main track

57a. Remotely Controlled Locomotive?
0 = Not a remotely controlled; 1 = Remote control portable

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56. Trailing Tons (gross tonnage, excluding power units): 0

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	0	N/A
(2) Causing (if mechanical cause reported)	0	0	N/A

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

Alcohol	Drugs
0	0

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
0	0	0	0

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): 0

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: 0

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

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: 0

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
	0	0

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): 0

103. Total Number of Highway-Rail Crossing Users (include driver): 0

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

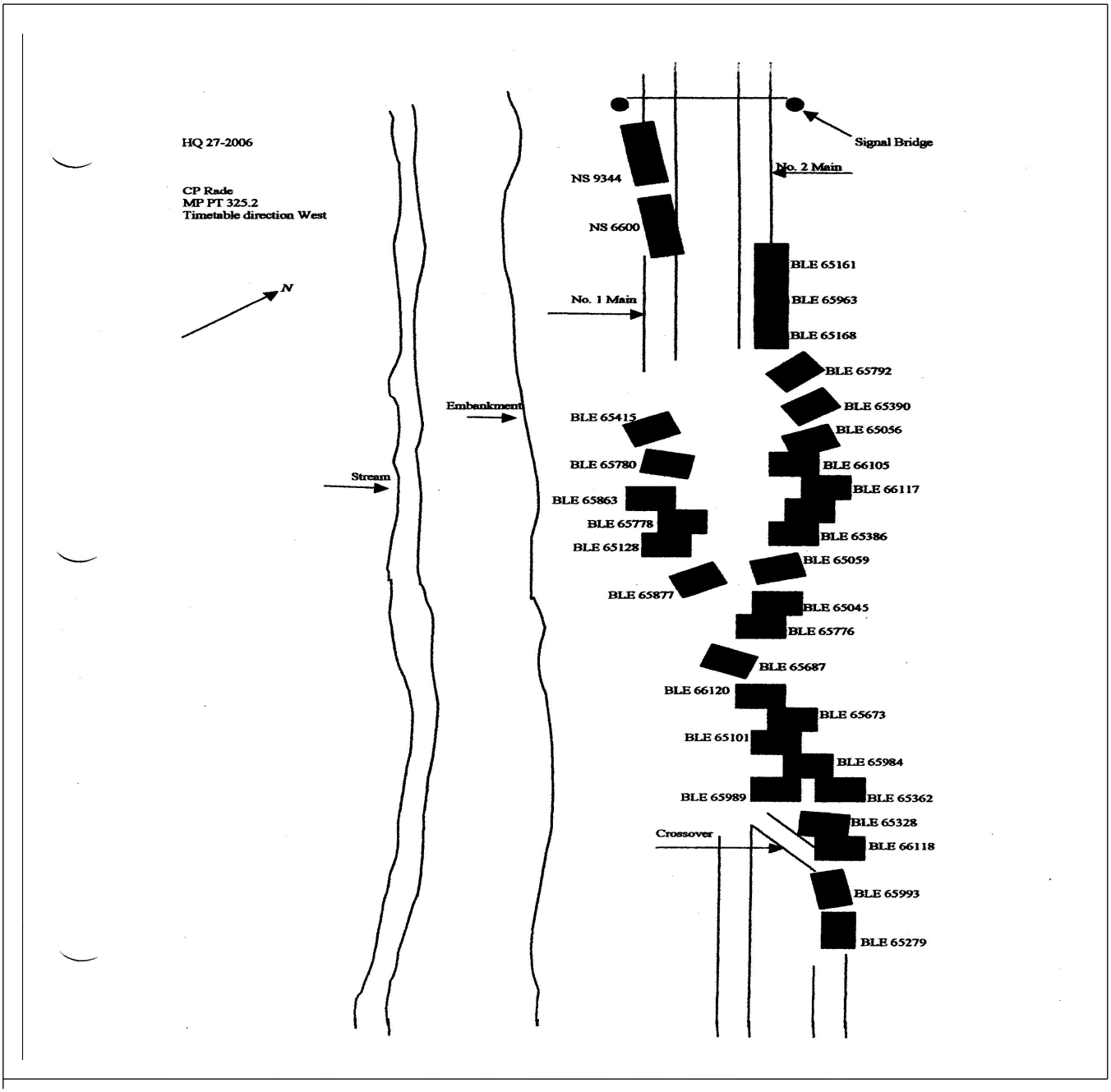
105. Locomotive Auxiliary Lights Operational? 1. Yes 2. No. Code: N/A

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.

SKETCHES HQ-27-2006 (2).jpg



109. SYNOPSIS OF THE ACCIDENT

On May 3, 2006, at 12:01 a.m., EST, Norfolk Southern Corporation (NS) train 72NC201 was traveling west on the Pittsburgh Division in route from Huff Power Plant at milepost PT 288.4 on No. 2 Main track with two locomotives, 59 loaded hopper cars, and two helper units. The recorded speed was 41 mph, when the train received an undesired emergency brake application.

The investigation revealed the lead two locomotives and first thirty hopper cars loaded with typsum were derailed. The westbound train was crossing from #2 Main track over to #1 Main track when the lead axle (#6), on NS 6600, hit the switch point and caused the train to derail. Both No. 1 and No. 2 Main tracks were effected by the derailment.

At the time of the accident it was dark and overcast, with minimal wind about 4 mph. The temperature was 52' F.

The primary cause of the accident was determined to be caused by the companion alternator being wired incorrectly, on locomotive NS 6600, when installed at NS's Juniata Locomotive Shop. Locomotive had just received an overhaul and a 92-day periodic inspection at the Juniata Locomotive Shop. the crossed wires caused the control circuits to be by passed. When dynamic brakes were applied, it allowed the field current to exceed the allowable threshold of 960 amps and go as high as 1200 amps. This caused the locomotive to apply the dynamic brake fully even when in position 2. This caused the #6 and #4 axles on the lead truck on NS 6600 to develop large flat spots. The flat spots were large enough to cause the wheels to develop groves in the tread of the wheel. When the lead axle (#6) started through the crossover it hit the switch point lifting the locomotive causing it to derail. A contributing factor was that the crew did not follow NS procedure to stop and inspect the train when the second warning reported detector not working, per NS, Office of Superintendent, Pittsburgh Division, Operating Bulletin No. 2, effective January 1, 2006.

The crew was not taken for Post Accident Toxicological Testing; because, NS's estimate of the damages was below the required threshold.

The estimate for damages was $585, 184 for equipment and $145,000 in track, signal and communication damages (T&SC). Total damage to equipment and T&SC was $730,184.

The No. 2 Main Track was restored for service on May 4, 2006, around 1:50 a.m. The No. 1 Main track was restored for service on May 4, 2006, around 3:40 a.m.

110. NARRATIVE

Circumstances Prior to the Accident:

The crew of train 72NC201 westbound, included a locomotive engineer, and a conductor. They reported for duty at 6:00 pm., EST, on May 2, 2006 at NS's Altoona Terminal, Altoona, PA, after receiving required rest period per FRA Hours of Service Law. They were shuttled to the Juniata Locomotive Shop to pick up their assigned locomotives, NS 9344 in the lead, and NS 6600 trailing. After inspecting the locomotives, performing a cab signal test, set up and release of the air brakes, and isolated the trailing unit, they departed the locomotive area like at approximately 6:15 p.m.

They proceeded to Huff Power Plant (milepost PT 288.4) to pick up their assigned train. The train consisted of the two locomotives and 59 hopper cars. The hopper cars were loaded with typsum ash. Prior to departing the power plant the conductor performed a Class 1 air brake test, an Appendix D mechanical inspection. They then pulled onto the main track, secured the helper units (C8VC202 with two locomotives). The Head End Device (HOT) was properly armed with the End of Train Device (EOT) and the crew tested for application and release of the train brakes before departing.

After departing the power plant the helper unit radioed the lead unit and reported that a handbrake was still applied to one of the cars on the read end of the train. The lead engineer stopped the train around MP PT 298. The conductor from the helper found the handbrake on the eight car from rear was applied and released the handbrake. The train then proceeded west.

The train proceeding at 52 mph as recorded on the controlling locomotive's event recorder, maximum authorized spped for this area is 55 mph per NS Timetable. At MP PT 304.4 they crossed a hot box detector and received a transmission saying "detector not working". They contacted the dispatcher and were instructed to stop and inspect the train. They stopped the train at MP PT 307. They they contacted the helper crew and the conductors from both crews started inspector the train. When the conductors met at the middle of the train they crossed over and processed to inspect the opposite side back to their locomotives. They found no defects.

The Pittsburgh East dispatcher told the crew of the 72nC201 to plan to cut the helper west of CP Rade (MP PT 325.0 at Radebaugh, PA).

Traveling at 51 mph as recorded on the controlling locomotive's event recorder, Maximum authorized spped for this area is 55 mph per NS Timetable. At MP PT 320.8 the train crossed a second hot box detector and received a transmission saying "detector not working". The engineer repeatedly tried to contact the dispatcher. During this time the locomotive slowed down to 22 mph, ascending a graade. At this time they started getting an alarm from the second unit. The engineer asked the conductor to go to the second unit to check on the alarm and the error message. The computer screen indicated that the locomotive had a ground fault problem. The conductor returned to the lead unit and informed the engineer of the problem.

The engineer was still trying to contact the dispatcher and told the helper he wanted to check the train again before releasing the helper units.

By this time the engineer had picked up spped after cresting the hill and was slowing down to 40 mph to crossover from #2 Main to #1 Main, as recorded on the controlling locomotive's event recorder. As the westbound train approached the accident site, the engineer was seated at the controls on the right side of the lead locomotive facing the direction of movement. The conductor was standing by the control stand trying to contact the dispatcher.

The track in this area consists of 140 lbs. Continuous welded rail (CWR), wood ties, common plates and ballast sub-grade. It is tangent track and has a 0.87% descending grade. Impact marks on both north and south rails were visible from MP PT 319.3 to MP PT325.2 the point of derailment (POD). The POD was determined to be at a 136 lbs., left-hand facing point No. 20 crossover switch. This location is at CP Rade interlocking and is a west cross-over diverting west bound trains from #2 Main track to #1 Main track. Tie, surface, track geometry, and ballast conditions were in compliance with Federal and NS standards.

The railroad timetable direction of the train was west. The geographic direction was northwest.

The Accident:

Train 72NC201 was being operated at a speed of 40 mph approaching the accident site. When the accident occurred the run-in-action of the train pushed the speed up to 41 mph as evidenced by the lead locomotive's event recorder. The maximum allowable speed through this area is 45 mph per NS Pittsburgh Division Timetable No. 4 effective at 12:01 a.m., Thursday, December 15, 2005, EST.

Train 72NC201 had created a grade at MP PT 323.3 and was on a descending grade of 0.87 degrees. The engineer had the locomotive in dynamic brake and had applied 10 lbs. of air pressure on the automatic brakes, as indicated on the controlling locomotive event recorder. The train was starting through crossovers at CP-Rade (MP PT 325.2) crossing from No. 2 Main to No. 1 Main track. The engineer felt a bump, that indicated to him the locomotive was on the ground. The train then experienced an undesired emergency air brake application. The engineer activated a radio broadcast "Emergency, Emergency, Emergency, CP-Rade in emergency, 72 N in emergency at CP-Rade". The engineer stated the locomotive stopped within three to four locomotive lengths. The engineer notified the dispatcher of the derailment and confirmed that all crew members were uninjured. The conductor carried his hand radio and he and the engineer climbed off the locomotive to investigate what caused the train's undesired emergency brake application. The conductor placed two fuses about 50 feet in front of the locomotives. The conductor and engineer tried to inspect the train from both sides, but the derailed cars prevented inspection past four car lengths. The crew remounted the lead locomotive and went to the trailing unit to shut it down and pulled the main circuit breaker. When they felt the lead unit shift in the ballast, they climbed down from the unit.

The first to arrive at the scene was the Grapeville EMS. First NS Officials at the scene were the NS police.

Investigation of the accident revelaed that both the lead and trailing locomotives, and the first 30 cars derailed. The locomotives, and the first 30 cars derailed. The locomotives were upright, listing slightly to the north. The first through the third cars were stretched out on their sides. The remaining 27 derailed cars were bunched together.

The lead axle (#6) on the right side of the trailing unit hit the switch point of the facing point on a No. 20 crossover switch. This caused the right #6 wheel to lift and jump the rail.

Total equipment damages were set at $585,184 and a total $145,000 for track, signal and communication damages.

Analysis and Conclusions:

Analysis:

Investigation of the accident revealed that the trailing locomotive in train 72NC201 (NS 6600) had developed flat spots on the left and right wheels on the number six and number four sales. Idler wheels were placed under the locomotive at the accident scene so the locomotive could be taken to NS's Conway Diesel Shop for inspection and investigation to the cause of the flat spots. The damaged wheels sets with traction motors were also sent to Conway for inspection.

The event recorder down load revealed that the trailing locomotive, NS 6600's dynamic brake current would spike around 1200 amps every time the lead locomotive, NS 9344, was placed in dynamic braking. The amperage range is between 940 and 960 amps.

On Thursday, May 4, 2006, investigation revealed both locomotives, NS 9344 and NS 6600, had received an overhaul and periodic inspection (92 day) at the NS Juniata Locomotive Shop (JLS). During the overhaul the main alternator was replaced on the NS 6600, on April 27, 2006.

On Friday, May 5, 2006, the traction motors and gear cases were examined and the only defects found were attributed to the derailment.

Saturday, May 6, 2005, a team of NS Officials and electricians began troubleshooting locomotive NS 6600 for what may have caused the No. 6 and No. 4 axles to develop flat spots. The NS team consisted of one electrician helper, an a general foreman from NS's JLS, an Electrical Engineer from NS Atlanta, a representative from EMD, and an FRA MP&E inspector. After many hours of troubleshooting and testing and tracing wires the EMD representative found that two small wires were crossed on the companion alternator (#11 and #21). Wire #11 was connected to terminal A2 and wire #21 was connected to terminal A1. The proper connection should have wire #11 connected to A1 and wire #21 connected to A2. The wires were properly connected to the terminals on the companion alternator. At the time little significances was given to this finding. After several more hours the investigation was completed for the day.

On Sunday, May 7, 2006, the investigation started again. After exhausting all other options the locomotive was pulled from the shop and coupled to another locomotive and pulled through the yard to try to recreate the problem. The track at the locomotive shop is not long enough to reach speeds about about 18 mph so the test was inconclusive. In the afternoon the transportation department gave eight miles on main line for testing at higher speeds. A locomotive was coupled to another locomotive and pulled onto the main line. the computer screen in the NS 6600 was set up to read several items including dynamic brake amps. The spped was increased to 50 mph and the dynamic brake was applied on the trailing unit (NS 6600) and the brakes work as designed. This test was run two more times with the similar results. The wires on the companion alternator were crossed to the way they were found on Saturday, and the test was run again. When the dynamic brake was applied the current reached 1200 amps and you could hear the wheels sliding. This was tried again with the same results. The wires were reconnected correctly and the test run again, everything operated as with the first series of tests. To verify the findings, the wires were crossed again, and again the dynamic brake amps reached 1200. The test was tried at a lower speed with the amps not reaching the 1200 amp mark but seemed high for the lower spped. After this test, it was concluded that the incorrect wiring of the companion alternator was the cause of the problem.

The companion alternator is physically connected to but electrically independent of the main alternator. The companion alternator provides power for the inertial blower motors, radiator blower motors, excitation for the main generator and for various control circuits. By crossing the wires you change the phases to the firing circuits. When this is done the Feedback Logic Module (FBL) control signals loose control. The FBL signals are used primarily for regulation of the Dynamic Brake System as well as other monitoring and protective functions. These signals are:

1. Brake Grid currents
2. Main Generator Field Excitation Current
3. Brake Grid Blower Voltages
4. Brake Grid Voltage
5. Traction Motor Voltages
6. Engine Temperature
7. Engine RPM
8. +2.5 V Reference Voltage

When the leading unit (NS 9344) was placed in dynamic brake the signal sent back to the trailing unit (NS 6600) the signal could not be controlled by the FBL and the amperage was applied fully to the dynamic brake grids. Thus allowing the braking forces to be applied fully to the wheels causing them to slide.

Conclusion:

Post accident investigation revealed that there were no FRA Regulations violated. The crew of the 72NC201 did not follow NS operation rules at the time of the accident: Office of the Superintendent, Pittsburgh Division, Operations Bulletin No. 2, effective January 1, 2006, Section 11.6, Failure Message. The crew was required to stop and inspect their train after receiving to detector failure messages in a row.

The investigation found that the NS 6600 had received an overhaul and periodic inspection and had just been released from NS's Juniata locomotive Shop (JLS). This was the first trip this NS 6600 since it was released from the shop. Further investigation discovered the main alternator was changed and in the process the

companion alternator was wired incorrectly (crossed wires). This caused the main alternator Firing Circuit Synchronization Module to fire the electrical phases out of sequence by passing some of the control circuits, including those effecting dynamic braking.

NS had a procedure LDI 4-24 "Phasing of Components with Companion Alternator Output" for checking components after wiring the companion Alternator. There were no quality control checks in place at the time the companion alternator was rewired. The procedure mentioned in the LDI was not followed. This is per information provided by NS Officials at the JLS. The only guidelines were, if you are not sure where the wire goes trace the wirer. The electrician performing the installation, saw two wires together and felt they were the correct wires and felt sure he connected them. This was for both terminals. Since this derailment has been attributed to the companion alternator being incorrectly wired, NS has issued a "Maintenance Alert EMD Companion Alternator Output Phasing".

NS, JLS took disciplinary action against the electrician who reqired the companion alternator. NS, also took disciplinary action against the crew of train 72NC201 for not following NS Operations Bulletin No. 2.

Probable Cause & Contributing Factors:

The FRA determined that the probable cause of the accident was the NS 6600's incorrect wiring of the companion alternator when the main alternator was installed during the locomotive's overhaul. This caused the firing synchronization circuits to fire the electrical phases out of sequence, causing several of the control circuits to lose the ability to perform their protective function. This included the Feedback Logic Module for dynamic braking. This caused flat spots on the #6 and #4 axles and lead to the #6 axle to hitting the switch point of the #20 crossover causing the locomotive to derail.

Contributing factors include the train crew not stopping to inspect the train after receiving two failure messages in a row from equipment detectors.