National Transportation Safety Board

Washington, D.C. 20594

Railroad Accident Brief

Accident No.:	DCA-11-FR-004
Location:	Mineral Springs, North Carolina
Date:	May 24, 2011
Time:	3:35 a.m. eastern daylight time
Railroad	CSX Transportation
Property Damage:	$1.6 million
Injuries:	2
Fatalities:	2
Type of Accident:	Rear-end collision

The Accident

On May 24, 2011, about 3:35 a.m. eastern daylight time,[1] northbound CSX Transportation (CSX) freight train Q19423 (striking train) was traveling about 48 mph on a single main track when it struck the rear of northbound CSX freight train Q61822 (struck train), which was stopped on the track near Mineral Springs, North Carolina. The struck train was stopped at a red signal, located at milepost (MP) 313.7 near Mineral Springs, waiting for another northbound train (train 616) on the track ahead to proceed. The accident occurred at MP 314 on the CSX Florence Division, Monroe Subdivision.

In the accident, two locomotives and the first nine cars of the striking train and the last four cars of the struck train derailed. (See figure 1.) The two crewmembers of the striking train were fatally injured; the two crewmembers of the struck train were treated for minor injuries. Property damage was estimated to be $1.6 million.

[1] All times in this brief are eastern daylight time unless otherwise noted.

Figure 1. View of accident site showing derailed cars from the striking train.

CSX train movements in the area of the accident were governed by wayside signals, controlled by CSX train dispatchers in Florence, South Carolina. The maximum authorized speed for freight trains on the Monroe Subdivision was 50 mph.

The struck train left Greenwood, South Carolina, on May 23 about 11:30 p.m., following northbound train 616. The striking train left Greenwood, South Carolina, on May 24 about 12:03 a.m., following the struck train.

About 3:24 a.m., the crew of the struck train arrived at Mineral Springs and stopped the train at a red signal at MP 313.7. Train 616 was stopped in front of them at a red signal at MP 308.5.

After stopping at the signal for about 10 minutes, train 616 began to move northward after receiving a green signal. Then the crew of the struck train received a green signal to proceed, and their train was struck by the striking train. (See figure 2.)

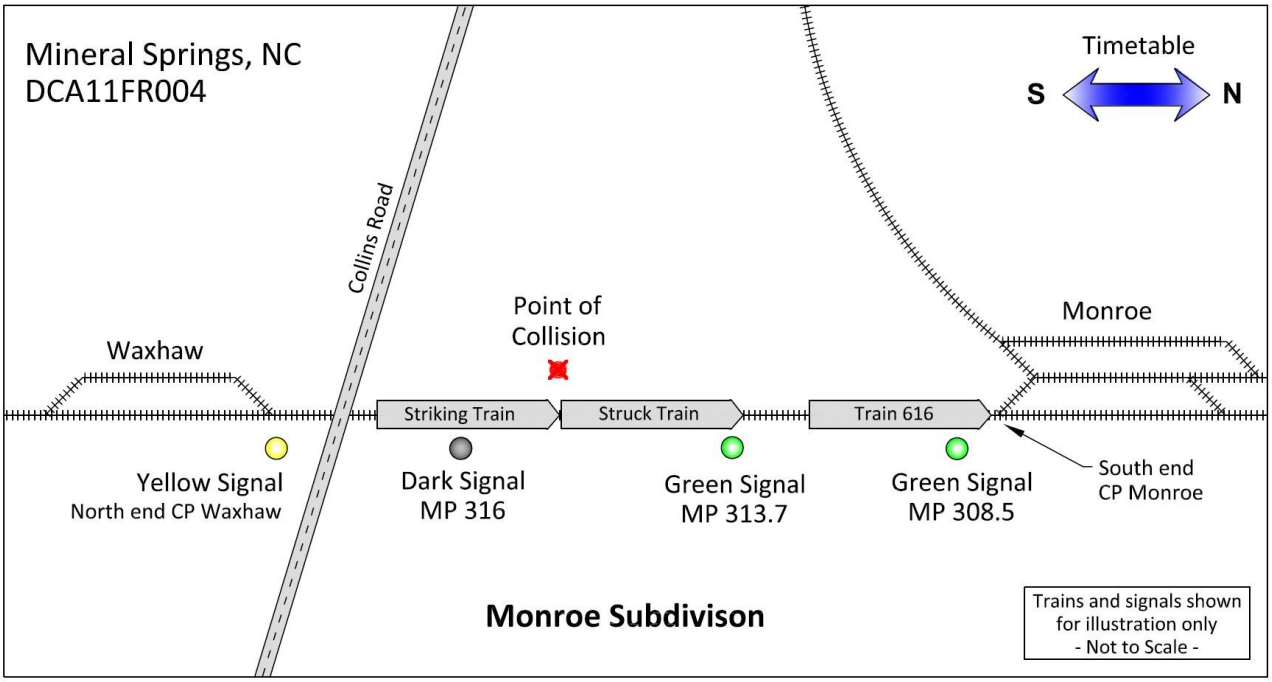

Figure 2. Diagram of accident area.

Investigation

Before the accident, the striking train had passed a yellow (approach) signal at the north end of control point[2] (CP) Waxhaw.[3] The CSX operating rules for an approach signal indication require train crews to proceed but be prepared to stop at the next signal while not exceeding 30 mph. However, the train's event recorder data indicated that the striking train had been traveling at speeds as great as 35 mph before reaching the signal at MP 316. This speed was noncompliant with the CSX operating rules.

National Transportation Safety Board (NTSB) investigators examined data from the forward-facing video camera on the striking train's locomotive. The data showed that when the striking train reached the signal at MP 316, the signal was dark (that is, not illuminated). This dark signal also was verified by investigators during postaccident signal testing. According to the CSX operating rules, a dark signal requires train crews to reduce train speed to the most restrictive indication the signal can convey and to contact the train dispatcher promptly. A G plate,[4] which was attached to the signal mast, allowed the train to pass the dark signal without stopping at a restricted speed of no more than 15 mph.[5] (See figure 3.) However, the striking train proceeded at 31 mph past the dark signal. The train accelerated and was traveling about

[2] A *control point* is a location on the railroad where the train dispatcher controls train movements by setting routes.

[3] Investigators verified this signal indication by analyzing both the forward-facing video camera on the locomotive and signal data.

[4] A *G plate* is a small sign with a large *G* that is attached to a signal mast. The *G* stands for grade.

[5] Restricted speed on CSX requires trains to operate prepared to stop short of a train ahead within one-half the range of vision, but not to exceed 15 mph.

48 mph just before the collision. Event recorder data showed no evidence that the engineer had applied the train's brakes before the collision.

Figure 3. NTSB signal investigators inspecting signal at MP 316 with attached G plate.

Sight Distance Tests

Sight distance tests were conducted in darkness, at a time similar to the time of the accident, as part of the investigation. Two locomotives of the same types as those of the striking train were used for the tests. From the operating cab of the lead locomotive, NTSB investigators were able to see the mast of the dark signal at MP 316, by the light of the locomotive's headlamp, from about 964 feet away. Investigators placed a simulated end-of-train device at the point of the collision, and they were able to see this device from about 450 feet away.

Because the crewmembers of the striking train were fatally injured and the locomotive cab was not equipped with either an inward-facing video recorder or an audio recorder, the investigation was unable to determine the crew's specific activities before the accident. However, investigators explored various explanations for why the crew had failed to slow the train to restricted speed at the dark signal and to stop the train before it struck the rear of the stopped train. The crew on the striking train was qualified and experienced at operating over the territory. They were familiar with the characteristics of the territory, including the location of each signal. Although the signal at MP 316 was dark, the postaccident sight distance tests indicated that the signal mast and an adjacent signal bungalow were visible at night with the locomotive's

headlamp, which suggests both that the crew would have expected a signal and that they likely noticed the dark signal.

Exclusions and Causal Factors

No track or mechanical conditions were identified that contributed to the accident. Postaccident sight distance tests, the review of weather records, and train crew interviews indicated that the weather and the visibility of the signals were not factors in the accident. No evidence of distraction from the use of personal electronic devices was found. Both train crews had been trained to perform their duties, were qualified on the accident territory, and had been tested on the CSX operating rules within the required timeframes.

After the accident, toxicological tests were performed on the two crewmembers of the struck train. A medical examiner conducted toxicological tests on the two fatally injured crewmembers of the striking train. The tests for alcohol and illegal drugs were conducted in accordance with 49 *Code of Federal Regulations* Part 219, Subpart C, *Post-Accident Toxicological Testing*. All test results were negative. The engineer and the conductor of the striking train were not known to be suffering from any medical conditions, and they had not been prescribed medications that would have affected their performance. There were no indications in their medical records that either crewmember was being treated for a sleep disorder.

The crew of the striking train had been on duty for 5 hours 50 minutes when the accident occurred at 3:35 a.m. This time of day corresponds to a low point in a person's circadian rhythm, when most people are physiologically and psychologically less alert and human performance can be degraded. However, based on a review of the train's event recorder data, up to the time of the accident the crew had been operating their train actively. They had made a series of throttle manipulations to maintain the train speed and sounded the train horn at highway-rail grade crossings, including the crossing at Collins Road, located about 2 miles from the point of collision.

Investigators considered whether fatigue contributed to the performance of the engineer and the conductor. A variety of fatigue factors were examined, including sleep (acute sleep loss, cumulative sleep debt, and sleep quality), continuous hours awake, circadian disruption, sleep disorders, medication use, disruptive environmental factors, and shift work considerations. However, the information obtained for the crew of the striking train was insufficient to determine whether fatigue was a factor in the accident.

Because the locomotive did not have in-cab video and audio recorders, the circumstances leading to the train crew's noncompliance with the wayside signal remains unknown. The NTSB has long advocated in-cab recording devices to better understand crew activities leading up to serious accidents.

Signal Information

During postaccident inspections, NTSB investigators found that all signal units, switches, and signal cases between the north end of CP Waxhaw and the south end of CP Monroe were locked and secured with no indications of tampering or vandalism. (CP locations are noted in figure 2.)

Testing of the signal at MP 316 revealed that the red aspect[6] of the signal was not illuminated. Further testing found that the signal lamp for the red aspect was burned out.

Investigators reviewed signal incident reports logged by CSX Electronic Signal Specialists[7] (ESS) between the controlled signals from the north end of CP Waxhaw and the south end of CP Monroe for the year before the accident. Investigators found two incident reports[8] that indicated that train crews had reported the signal at MP 316 as dark. Further investigation determined that for both incidents, a signal maintainer had been notified that the signal at MP 313.7 was displaying a red.

During postaccident interviews, CSX signal maintainers could not recall whether they were informed about the dark signal at MP 316. Investigators reviewed voice recordings of the telephone conversations between the ESS and the signal maintainers about the two incidents. On both occasions, the ESS had informed the signal maintainers about the red signal at MP 313.7 and the dark signal at MP 316. The incident reports about the two signal conditions indicated that the reported red signal at MP 313.7 had been resolved and that trains were observed while operating to verify the repairs. However, the incident reports did not contain any information about the dark signal at MP 316.

The CSX requires that signal incident reports be logged into a computerized tracking system. This action opens a "trouble ticket" that notifies signal maintenance personnel of identified problems. To close a ticket, a remedy must be entered into the system. At the time of the accident, CSX procedures allowed more than one signal defect to be listed on a trouble ticket. In addition, the procedures did not require all malfunctions reported on a ticket to be addressed before a ticket could be closed.

In this case, both the red signal at MP 313.7 and the dark signal at MP 316 were reported in the same ticket. The ticket was closed once the red signal at MP 313.7 was resolved.

According to the CSX's operating rules, the action required at the dark signal was the same action required if the signal had been red. In either case, the crew of the striking train was required to reduce the train speed to the most restricting indication (restricted speed, no more

---

[6] An *aspect* is defined by the Federal Railroad Administration (Title 49 *Code of Federal Regulations* 236.703) as "the appearance of a roadway signal conveying an indication as viewed from the direction of an approaching train; the appearance of a cab signal conveying an indication as viewed by an observer in the cab."

[7] CSX Electronic Signal Specialists are signal department employees stationed at the CSX Operations Center who act as liaisons between the dispatchers and the signal department to address signal problems that are either encountered by the dispatchers or reported by train crews.

[8] The two signal incident reports were dated April 25, 2011, and May 20, 2011.

than 15 mph). Therefore, the failure of the CSX to repair the reported dark signal, although it was a fault within the incident reporting system, was not a factor in this accident.

Postaccident Actions

During the on-scene investigation, CSX representatives recognized a fault in the CSX signal incident reporting procedures. The CSX implemented a corrective change, and reporting procedures now allow only one signal incident to be reported on each trouble ticket. To close a ticket, signal personnel must enter a specific remedy for the reported incident.

Positive Train Control

Had a positive train control (PTC) system been installed on this track, it could have prevented the collision. The striking train was traveling at 31 mph when it passed the dark (restricting) signal at MP 316, and it continued to accelerate to about 48 mph just before the collision. A PTC system would have intervened by activating an audible warning in the locomotive to alert the train crew of the over-speed condition. If the train crew did not reduce the train's speed, the PTC system could have initiated an automatic brake application to stop the train before it traveled 2 miles to the point of the collision. After the train had been stopped by the PTC system, the engineer would have been required to reset the locomotive controls to allow the train's brake system to recharge and to release the brakes. This process would have taken several minutes. While the striking train was waiting for the train brakes to release, the struck train would have been moving forward to the signal at MP 308.5.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the accident was the failure of the striking train crew to comply with the speed restriction required when they encountered a dark signal. Contributing to the accident was the lack of a positive train control system that could have prevented the accident.

Adopted: January 29, 2013