National Transportation Safety Board

Washington, D.C. 20594

Railroad Accident Brief

Accident No.:	DCA-06-FR-004
Location:	Lincoln, Alabama
Date:	January 18, 2006
Time:	4:17 p.m. central standard time
Railroad:	Norfolk Southern Railway
Property Damage:	$5.2 million
Injuries:	3
Fatalities:	None
Type of Accident:	Rear-end collision and derailment

Accident Synopsis

About 4:17 p.m., central standard time,[1] on January 18, 2006, eastbound Norfolk Southern Railway (NS) freight train No. 226A117 (226), while traveling about 50 mph near Lincoln, Alabama, diverted from the main track onto a siding track where it struck the rear of eastbound NS train No. 22RA116 (22R), which was stopped in the siding. The collision derailed the three locomotives and the first seven cars of train 226 and the rear three cars of train 22R. The three crewmembers of train 226 were injured. Property damage was estimated to be about $5.2 million.

Accident Sequence

Train 22R originated in New Orleans, Louisiana. Train 226 originated in Los Angeles, California. Both trains were destined for Atlanta, Georgia, and both trains were re-crewed at the NS Birmingham, Alabama, terminal at Norris Yard, milepost (MP) 791, before continuing to Atlanta. The crew of train 226[2] (engineer, conductor, and

[1] All times referenced in this brief are central standard time.

[2] The train 226 locomotive engineer was hired on May 5, 1978, as a brakeman. On April 21, 1997, he was promoted to locomotive engineer and started working in the district. The conductor was hired on April 18, 2005, as a conductor trainee. On September 19, 2005, he was promoted to conductor. The conductor trainee was hired on October 20, 2005. At the time of the accident, he was working in that capacity.

conductor trainee) went on duty at Norris Yard at 1:15 p.m. on January 18, 2006. The train 22R crew[3] (engineer, conductor, and engineer trainee) went on duty at 1:35 p.m.

Train 22R departed Norris Yard at 2:30 p.m.[4] The train had 2 locomotives pulling 81 cars and was trailing 6,046 tons. It was 8,276 feet long. Train 226 departed the yard at 2:50 p.m. with 3 locomotives pulling 23 cars (all of which were platform cars loaded with intermodal containers[5]) and trailing 3,582 tons. The train was 4,580 feet long. Train 226 left the yard behind train 198, which was following train 22R. About 9 miles from Norris Yard, train 198 diverged from the east-west main line and started southward toward Columbus, Georgia. At that point, train 226 was following train 22R on signal indication.[6]

About 3:49 p.m., the NS dispatcher radioed the crew of train 22R to inform them that they would be taking their train into the siding at Coosa (MP 758) to allow train 226 to pass on the main line.[7] The crew of train 226 said that they overheard this conversation and were therefore expecting to run around train 22R at Coosa. The train 226 engineer (who had also worked as an engineer on train 22R) said it was common for train 226 to be following train 22R. And because train 22R often had to work a local automobile plant en route while train 226 was a "hot shot," or priority train,[8] the dispatcher would routinely direct train 22R into a siding to allow the through train to pass.

As it followed train 22R, train 226 passed several *clear* signals[9] before encountering consecutive *approach* signals[10] at Holt (MP 767.8),[11] Eden (MP 765.4), and Pell City (MP 762.8). These signals were consistent with the presence of train 22R ahead. The *approach* signal at Pell City meant that the crew had to be prepared to stop

[3] The train 22R engineer was hired in January 1997; he had worked as an engineer for this territory for the last 5 years. About 1 year before the accident, NS had hired the locomotive engineer trainee as a conductor.

[4] As train 22R was leaving Norris Yard in Birmingham, a trackman noticed that a door was open on the 66th car and radioed the train. When the train stopped, a road foreman of engines (RFE) boarded and gave his pickup truck to the conductor to use in checking the open door. The foreman rode the train and instructed the conductor to rejoin the train at Coosa. The RFE had 12 years of experience with NS. He had worked 2 years as a brakeman, 9 years as a locomotive engineer, and about 1 year as a supervisor of locomotive engineers.

[5] All the cars on the train were articulated cars with platforms specially designed to accommodate stacked intermodal containers (containers designed to be transported by more than one form of carrier, such as truck, rail, or ship). The lengths of the individual cars varied depending on the number of platforms.

[6] In this centralized traffic control system, wayside signals along the main track sense the presence of trains within a defined block of track and automatically display the appropriate signals to other trains that may be approaching the occupied block. (Some of the signals can also be controlled by the dispatcher.)

[7] The dispatcher operated the siding switch remotely.

[8] A *priority train* is one that is operated so as to minimize delays en route.

[9] A *clear* signal indication allows a train to operate at the maximum speed authorized for the track segment.

[10] An *approach* signal indication requires that a train slow and be prepared to stop before passing the next signal.

[11] Milepost numbers decrease going east.

before passing the next signal, at Riverside (MP 760.4), which was the last signal before the siding at Coosa. (A map of these signals is shown in figure 1.)

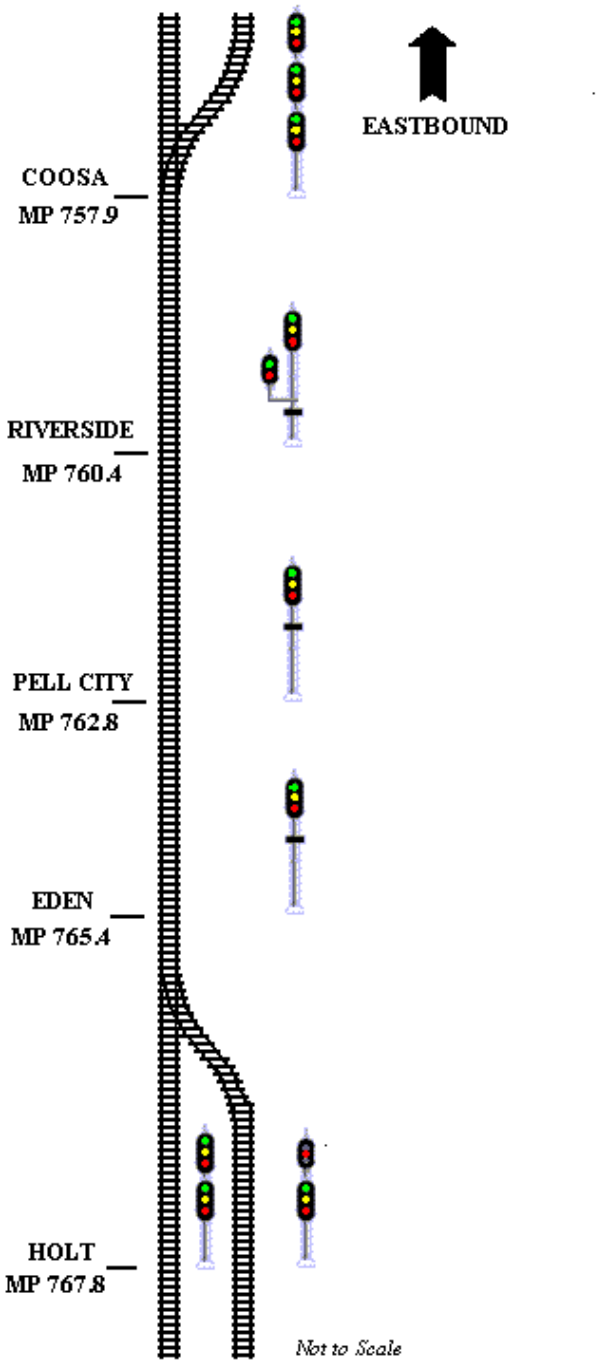

Figure 1. Map displaying selected signals that train 226 encountered before reaching Coosa.

About 4:03 p.m., as train 226 was passing the *approach* signal at Pell City, train 22R was diverting from the main track and entering the siding at Coosa. The train 226 conductor said he had heard the train 22R crew announce (on the radio) a *diverging approach* indication[12] at Coosa and was therefore aware that the train was entering the siding and would thus be clear of the main line before the arrival of train 226.

While train 22R was moving from the main track into the siding, the signal just west of the siding was displaying a *stop* indication to following trains. This indication triggered the signal at Riverside, about 2 miles west of Coosa, to display a *restricting* indication[13] for train 226.

The dispatcher stacked consecutive train movement requests into the centralized traffic control equipment and lined train 22R into the siding. In this situation, the switch would line for the main track after the rear car cleared the siding switch track circuit. The signal system would then light the corresponding signal aspect after the switch was lined for the main track. In this case, however, when train 22R stopped in the siding, about 84 feet of the rear of the train—though physically well clear of the main line—remained within the switch circuit. As a result, the switch remained lined for the siding, and the signals continued to display *stop* and *restricting* indications.

A student engineer was at the operating controls of train 22R when it entered the siding. The student engineer did not activate the footage counter when the head of the train passed over the insulated joint at the west end of the siding.[14] Train 22R was stopped at a familiar landmark near the east end of the siding. The crew of 22R were not aware that the rear car was occupying the circuit of the west switch.

Meanwhile, according to interviews and event recorder data, the engineer of train 226 had reduced the speed of his train to between 2 and 5 mph as the train came around the 2° curve at the approach to the signal at Riverside.[15] According to signal and dispatcher data, the Riverside signal, because of the switch alignment at Coosa, was displaying a *restricting* indication; that is, a single red aspect on both the high and low signal heads.[16] (See figure 2.) According to the train 226 engineer, however, he saw the signal as "green over red." He said he observed that signal for "probably a minute."

[12] A *diverging approach* indication requires that the engineer slow the train to the prescribed speed for diverging through an upcoming switch onto another track.

[13] The *restricting* indication requires that the train proceed at a speed, not exceeding 15 mph, that permits stopping short of railroad equipment, a stop signal, a derail or switch not properly lined, or broken rail.

[14] The NS does not require train crews to use a distance counter in signalized territory, and the Federal Railroad Administration does not require the use of a distance counter at any time.

[15] The engineer was operating his train in accordance with the *approach* indication he had received at Pell City, which required that he be prepared to stop the train before passing the signal at Riverside.

[16] The high signal head of the signal at Riverside had three aspects (green, yellow, and red, top to bottom); the low signal head had two aspects (green, at the top, and red).

Figure 2. Eastbound signal at Riverside as seen from a locomotive cab during postaccident sight distance testing. The high signal head has three aspects: green over yellow over red. The lower, offset, signal head has two aspects: green over red. This configuration should be considered an improperly or imperfectly displayed signal.

The train 226 engineer stated:

> I looked at it [the signal at Riverside] for the last time, and we still had a clear signal. I called it again in the cab, still clear, and at that time I called it over the radio.

The train 22R crew told investigators that they heard train 226 call "clear" at Riverside.[17] The dispatcher told investigators that she did not hear this clear call because she was tending to other duties. The conductor and conductor trainee, who were in the 226 locomotive cab at the time, also remembered calling the signal as *clear*.

Event recorder data indicated that train 226 passed the Riverside signal at about 18 mph. The train then proceeded toward Coosa while increasing its speed, in accordance

[17] The crew of train 22R was not aware that the rear of their train was within the switch circuit. They therefore would have thought that the siding switch had returned to normal and would have expected the signal at Riverside to be displaying a *clear* indication.

with the *clear* indication the crew believed they had seen at Riverside. As the train exited a 3° curve (restricted to 55 mph) west of Coosa at 53 mph, the crew were able to observe the *stop* indication at Coosa and could see the switch alignment. The engineer said he was preparing to announce the signal indication for Coosa on the radio when he saw the *stop* signal and realized that the switch was lined for the siding. Instead of announcing the indication, he simply transmitted, "Oh Lord!"

The engineer placed the train's braking system into emergency, but the train only slowed to about 45 mph before striking the rear of train 22R.[18] The three crewmembers braced for the impact and were able to exit the cab after the collision. Emergency responders examined the crewmembers and transported them to a local hospital where the conductor trainee was treated and released. The engineer and conductor were treated and held for observation. The crew of train 22R were not injured.[19]

The collision derailed the three locomotives of train 226 and its first seven cars. (These were platform cars carrying a total of 34 intermodal containers and one semi-trailer.) The three rear cars of train 22R, loaded automobile carriers, also derailed. The collision and derailment occurred during bright daylight under sunny, clear skies. The temperature was 53° F, and winds were from the west-southwest at 6 to 8 mph.

Sight Distance Tests

On January 25 and 26, 2006, investigators, using a locomotive and locomotive configuration (short hood forward) similar to those of train 226 on the day of the accident, conducted sight distance tests of the NS main line signals at Pell City, Riverside, and Coosa. The testing was conducted under sunny, clear skies and at a time when the sun approximated its position at the time train 226 had passed the signals on the day of the accident. For the tests, the siding switch at Coosa was lined and locked for the siding, and the Coosa signal was energized to display *stop*. This caused the signal at Riverside to display *restricting*, as it had when train 226 passed the signal on the day of the accident.

[18] About 4 minutes after the collision, the dispatcher saw track lights on the dispatch board that raised her concern about whether train 22R was clear of the switch, and she called the crew of train 22R. The engineer thought that the train was clear but said that he would move the train forward to "clear it up." Neither the dispatcher nor the engineer was aware that the collision had occurred.

[19] The crewmembers of both trains and the dispatcher underwent postaccident toxicological testing in accordance with 49 *Code of Federal Regulations* 219, Subpart C. All eight employees tested negative for illicit drugs and alcohol. Three employees (the engineer trainee of train 22R, the engineer of train 226, and the dispatcher) tested positive for prescription medications. The use of these medications was not a factor in this accident.

About 1,230 feet before the Riverside signal, investigators observed two red aspects (one on the upper signal head and one on the lower signal head), which is the correct aspect for a *restricting* indication.

The train then slowly moved forward by 40 feet, until it was within 1,189 feet of the signal. At that point, the green aspect at the top of the upper signal head appeared to be illuminated, even though the green aspect was not energized. As the locomotive pulled slowly forward, the green aspect became even more prominent. The red aspect in the same signal head remained energized and continued to be visible to those in the locomotive cab. The upper signal head's top aspect continued to appear to display green as the locomotive approached and then passed the signal. During a subsequent test run at accident train speed, the Riverside upper signal head again appeared to display two aspects—green over red—even though the green was not energized.

The next day, investigators again performed sight distance tests at Riverside. The results were the same as on the previous day, and investigators determined that the period of time the green aspect appeared to be illuminated was about 1 hour. Although the green light was not energized, it appeared to be illuminated because of sunlight reflecting from its lens. After the sight distance tests, the railroad installed devices at Riverside to better shield the lights from sun reflection.

NS Signal Recognition

Signal A in figure 3 illustrates the signal as energized at the time of the accident, displaying a *restricting* indication. Note that the *restricting* indication is displayed as a single red light illuminated in each of the upper and lower signal heads. Signal B in figure 3 illustrates the signal as it appeared in postaccident sight distance tests. Signal B is somewhat similar to signal A, but it has one critical difference: in addition to the single red light on each of the signal heads, a green light appears to be illuminated in the upper head. Because no legitimate NS signal indication uses this combination of illuminated aspects, this configuration should be considered an improperly or imperfectly displayed signal.

NS operating rule No. 27 had instructions for employees who encountered an imperfectly displayed signal. The rule stated, in part:

> A signal imperfectly displayed, a signal functioning erratically, the absence of a light at a place where a signal is usually shown, must be regarded as the most restrictive indication that can be given by that signal and must be promptly reported to the Dispatcher, Control Station, or Yardmaster.

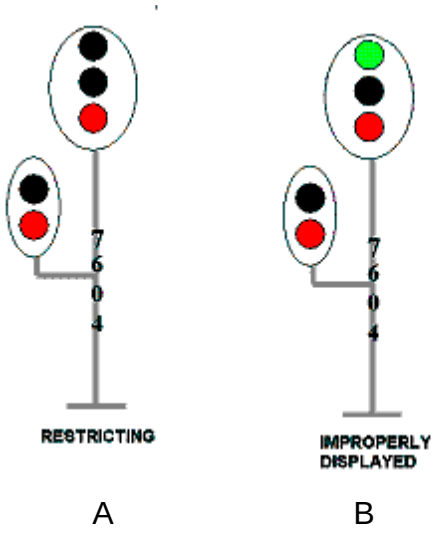

Figure 3. Signal at Riverside at time of accident as it was energized (A) and as it was observed during postaccident tests (B).

Neither NS operating rule No. 27 nor any of the rule book's signal illustrations or accompanying text informed employees that extra lighted aspects[20] in a signal head indicate an anomaly in the observed signal, that such a signal should be considered an imperfectly displayed signal, and that it should be treated as if it were displaying its most restrictive indication.

The NS provides its employees with classroom and practical training at the company's training facility in McDonough, Georgia. Operating employees are taught to recognize and respond appropriately to signal indications. To prepare trainees to recognize improperly displayed signals, training staff set signals with signal lights out or flickering.

During classroom work, because of the variety of signal types employees might encounter on the company's widespread territories, trainees use a computer system that displays signals as depicted in the NS rule book. Employees are expected to learn the various signal configurations used on their specific territories while they are undergoing on-the-job training with regular crews.

[20] Some signal configurations (for example, directional signals) display more than one lighted aspect in the same signal head; *extra* lighted aspects are aspects in addition to those displaying a legitimate signal indication.

Probable Cause

The National Transportation Safety Board determines that the probable cause of the January 18, 2006, collision of Norfolk Southern Railway train 226 with the rear of Norfolk Southern Railway train 22R at Lincoln, Alabama, was the failure by the crew of train 226 to recognize an extra lighted aspect (caused by reflected sunlight) as an imperfectly displayed signal and to treat it as a most restrictive indication. Contributing to the accident was Norfolk Southern Railway's inadequate illustrations and text in the rulebook and inadequate training to prepare crews to recognize a signal displaying an extra lighted aspect as an imperfectly displayed signal. Also contributing to the accident was the lack of a positive train control system that would have intervened when the crew did not respond appropriately to the signal.

Recommendations

As a result of its investigation of the January 18, 2006, collision of Norfolk Southern train 226 with the rear of Norfolk Southern train 22R at Lincoln, Alabama, the National Transportation Safety Board made the safety recommendations listed below. (For more information about these recommendations, see the safety recommendation letters issued to the recipients.[21])

To the Norfolk Southern Railway Company:

> Modify your initial and recurrent training and operating rules to emphasize to your employees and the crews of other railroads operating on your territory that any signal that appears to display extra lighted aspects in a signal head should be treated as an imperfectly displayed signal. (R-07-29)

To the Class I Railroads:

> After reviewing the circumstances of the January 18, 2006, railroad collision near Lincoln, Alabama, modify, as necessary, your initial and recurrent training and operating rules to emphasize to your employees and the crews of other railroads operating on your territory that any signal that appears to display extra lighted aspects in a signal head should be treated as an improperly or imperfectly displayed signal. (R-07-30)

[21] The recommendation letters are available on the Safety Board's Web site at <www.ntsb.gov>.

To the Association of American Railroads and the American Short Line and Regional Railroad Association:

Using the circumstances of the January 18, 2006, railroad collision near Lincoln, Alabama, inform your members through your publications, web site, and conferences of the need to enhance their signal training to emphasize that extra lighted aspects in a signal head should be treated as an improperly displayed signal. (R-07-31)

BY THE NATIONAL TRANSPORTATION SAFETY BOARD

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Adopted: October 26, 2007

Chairman Rosenker and Member Chealander disapproved adoption of this brief.